NIST NCSTAR 1-8

Federal Building and Fire Safety Investigation of the World Trade Center Disaster

The Emergency Response Operations

J. Randall Lawson
Robert L. Vettori

NIST National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

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Building and Fire Research Laboratory
National Institute of Standards and Technology

September 2005

U.S. Department of Commerce
Carlos M. Gutierrez, Secretary

Technology Administration
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National Institute of Standards and Technology
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- Ronald Meininger, assisted with formatting and enhancing emergency response audio recordings.

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The following personnel provided expert views related to the investigation's planning, data gathering, and review of information.

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DEDICATION

On September 11, 2001, the City of New York was attacked by terrorists who flew large commercial aircraft into the twin towers of the World Trade Center. Immediately, emergency responders from across the city began operations to protect the citizens of New York City and to save lives at the World Trade Center. With these efforts, many emergency responders gave their lives, and many more were seriously injured. The injuries from this attack were more than physical. The emotional toll for these emergency responders and their families will always be with them. This report is dedicated to all the emergency responders who lost their lives that morning, to all emergency responders who were injured, and to all emergency responders and the families who live with the anguish caused by this attack.

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ABSTRACT

The September 11, 2001, attack on the World Trade Center (WTC) caused the deaths of 2,749 people. Included in the group were approximately 421 emergency responders from The Fire Department of the City of New York (FDNY), The New York City Police Department (NYPD), the Port Authority Police Department (PAPD), The Port Authority of New York and New Jersey (PANYNJ), from WTC security firms, and volunteer emergency responders who were in the WTC area of the city when the attack occurred. This report addresses the operations of these emergency responders, the technologies used during WTC operations, and the guidelines and practices that governed these operations. The objectives of this study were to 1) fully document what happened during the response by the emergency services to the attacks on the WTC, up to the time of collapse of WTC 7; (2) identify issues that need to be addressed in changes to practice, standards, and codes; (3) identify alternative practices and/or technologies that may address these issues; and (4) identify R&D needs that advance the safety of the fire service in responding to massive fires in tall buildings.

The approach taken was to conduct a comprehensive search for data related to the emergency response on September 11, 2001, analyze the data, and report on the findings. Data gathering included the collection of written documents, electronic recordings, visual data (both photographs and video), and first-person accounts of what happened during WTC operations. Results from this investigation show that the emergency responders were faced with the greatest disaster of the last 100 years in the United States. The emergency responders had one common focus: to save as many victims of this attack as possible. During the response, emergency responders had to function under war-like conditions as they carried out their rescue and evacuation efforts. Emergency responders operated with equipment, human endurance, and emergency response practices that were stretched well beyond normal limits. This report discusses how the emergency response activities and equipment were challenged. The emergency responders paid a heavy price in the loss of hundreds of their own lives when the WTC buildings collapsed.

This study focused on the following topics:

- emergency responder dispatch and response to the WTC
- emergency responder access to the WTC site and towers
- command and control associated with the emergency response
- communications during operations and the of communications in tall buildings
- firefighting in high-rise buildings and the evacuation from the WTC towers
- emergency responder situational awareness and the physiological impact of conducting operations in tall buildings

Keywords: Buildings, emergency responders, emergency medical service, evacuation, firefighters, firefighting, police, rescue, search, World Trade Center.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronyms

EMS	Emergency Medical Services
ESU	New York City Police Department and PATH Police, Emergency Service Unit
FDNY	The Fire Department of the City of New York
HAZMAT	Hazards Materials
HT	handie-talkie radio
HVAC	heating, ventilating, and air conditioning system
ICP	Incident Command Post
ICS	Incident Command System
NIST	National Institute of Standards and Technology
NYPD	The New York City Police Department
OEM	New York City Office of Emergency Management
PANYNJ	The Port Authority of New York and New Jersey
PAPD	Port Authority Police Department
PATH	Port Authority Trans-Hudson Transportation System
SCBA	Self-Contained Breathing Apparatus
UHF	Ultra-high Frequency Radio, frequencies from 300 to 3000 MHz
VHF	Very-high Frequency Radio, frequencies from 30 to 300 MHz
WFC	World Financial Center at the World Trade Center Complex
WTC 1	World Trade Center 1 (North Tower)
WTC 2	World Trade Center 2 (South Tower)
WTC 7	World Trade Center 7

Abbreviations

ft	foot
gal	gallon
in	inch
kg	kilogram
l	liter

lb	pound
m	meter
MHz	Megahertz
min	minute
mm	millimeter

METRIC CONVERSION TABLE

To convert from	to	Multiply by
AREA AND SECOND MOMENT OF AREA		
square foot (ft^2)	square meter (m^2)	9.290 304 E-02
square inch ($in.^2$)	square meter (m^2)	6.4516 E-04
square inch ($in.^2$)	square centimeter (cm^2)	6.4516 E+00
square yard (yd^2)	square meter (m^2)	8.361 274 E-01
ENERGY (includes WORK)		
kilowatt hour (kW · h)	joule (J)	3.6 E+06
quad (1015 BtuIT)	joule (J)	1.055 056 E+18
therm (U.S.)	joule (J)	1.054 804 E+08
ton of TNT (energy equivalent)	joule (J)	4.184 E+09
watt hour (W · h)	joule (J)	3.6 E+03
watt second (W · s)	joule (J)	1.0 E+00
FORCE		
dyne (dyn)	newton (N)	1.0 E-05
kilogram-force (kgf)	newton (N)	9.806 65 E+00
kilopond (kilogram-force) (kp)	newton (N)	9.806 65 E+00
kip (1 kip=1,000 lbf)	newton (N)	4.448 222 E+03
kip (1 kip=1,000 lbf)	kilonewton (kN)	4.448 222 E+00
pound-force (lbf)	newton (N)	4.448 222 E+00
FORCE DIVIDED BY LENGTH		
pound-force per foot (lbf/ft)	newton per meter (N/m)	1.459 390 E+01
pound-force per inch (lbf/in.)	newton per meter (N/m)	1.751 268 E+02
HEAT FLOW RATE		
calorieth per minute (calth/min)	watt (W)	6.973 333 E-02
calorieth per second (calth/s)	watt (W)	4.184 E+00
kilocalorieth per minute (kcalth/min)	watt (W)	6.973 333 E+01
kilocalorieth per second (kcalth/s)	watt (W)	4.184 E+03

To convert from	to	Multiply by
LENGTH		
foot (ft)	meter (m)	3.048 E-01
inch (in)	meter (m)	2.54 E-02
inch (in.)	centimeter (cm)	2.54 E+00
micron (m)	meter (m)	1.0 E-06
yard (yd)	meter (m)	9.144 E-01
MASS and MOMENT OF INERTIA		
kilogram-force second squared per meter ($kgf \cdot s^2/m$)	kilogram (kg)	9.806 65 E+00
pound foot squared ($lb \cdot ft^2$)	kilogram meter squared ($kg \cdot m^2$)	4.214 011 E-02
pound inch squared ($lb \cdot in.^2$)	kilogram meter squared ($kg \cdot m^2$)	2.926 397 E-04
ton, metric (t)	kilogram (kg)	1.0 E+03
ton, short (2,000 lb)	kilogram (kg)	9.071 847 E+02
MASS DIVIDED BY AREA		
pound per square foot (lb/ft^2)	kilogram per square meter (kg/m^2)	4.882 428 E+00
pound per square inch (*not* pound force) ($lb/in.^2$)	kilogram per square meter (kg/m^2)	7.030 696 E+02
MASS DIVIDED BY LENGTH		
pound per foot (lb/ft)	kilogram per meter (kg/m)	1.488 164 E+00
pound per inch (lb/in.)	kilogram per meter (kg/m)	1.785 797 E+01
pound per yard (lb/yd)	kilogram per meter (kg/m)	4.960 546 E-01
PRESSURE or STRESS (FORCE DIVIDED BY AREA)		
kilogram-force per square centimeter (kgf/cm^2)	pascal (Pa)	9.806 65 E+04
kilogram-force per square meter (kgf/m^2)	pascal (Pa)	9.806 65 E+00
kilogram-force per square millimeter (kgf/mm^2)	pascal (Pa)	9.806 65 E+06
kip per square inch (ksi) ($kip/in.^2$)	pascal (Pa)	6.894 757 E+06
kip per square inch (ksi) ($kip/in.^2$)	kilopascal (kPa)	6.894 757 E+03
pound-force per square foot (lbf/ft^2)	pascal (Pa)	4.788 026 E+01
pound-force per square inch (psi) ($lbf/in.^2$)	pascal (Pa)	6.894 757 E+03
pound-force per square inch (psi) ($lbf/in.^2$)	kilopascal (kPa)	6.894 757 E+00
psi (pound-force per square inch) ($lbf/in.^2$)	pascal (Pa)	6.894 757 E+03
psi (pound-force per square inch) ($lbf/in.^2$)	kilopascal (kPa)	6.894 757 E+00

To convert from	to	Multiply by
TEMPERATURE		
degree Celsius (°C)	kelvin (K)	T/K = t/°C + 273.15
degree centigrade	degree Celsius (°C)	t/°C ≈ t /deg. cent.
degree Fahrenheit (°F)	degree Celsius (°C)	t/°C = (t/°F - 32)/1.8
degree Fahrenheit (°F)	kelvin (K)	T/K = (t/°F + 459.67)/1.8
kelvin (K)	degree Celsius (°C)	t/°C = T/K 2 273.15
TEMPERATURE INTERVAL		
degree Celsius (°C)	kelvin (K)	1.0 E+00
degree centigrade	degree Celsius (°C)	1.0 E+00
degree Fahrenheit (°F)	degree Celsius (°C)	5.555 556 E-01
degree Fahrenheit (°F)	kelvin (K)	5.555 556 E-01
degree Rankine (°R)	kelvin (K)	5.555 556 E-01
VELOCITY (includes SPEED)		
foot per second (ft/s)	meter per second (m/s)	3.048 E-01
inch per second (in./s)	meter per second (m/s)	2.54 E-02
kilometer per hour (km/h)	meter per second (m/s)	2.777 778 E-01
mile per hour (mi/h)	kilometer per hour (km/h)	1.609 344 E+00
mile per minute (mi/min)	meter per second (m/s)	2.682 24 E+01
VOLUME (includes CAPACITY)		
cubic foot (ft^3)	cubic meter (m^3)	2.831 685 E-02
cubic inch ($in.^3$)	cubic meter (m^3)	1.638 706 E-05
cubic yard (yd^3)	cubic meter (m^3)	7.645 549 E-01
gallon (U.S.) (gal)	cubic meter (m^3)	3.785 412 E-03
gallon (U.S.) (gal)	liter (L)	3.785 412 E+00
liter (L)	cubic meter (m^3)	1.0 E-03
ounce (U.S. fluid) (fl oz)	cubic meter (m^3)	2.957 353 E-05
ounce (U.S. fluid) (fl oz)	milliliter (mL)	2.957 353 E+01

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PREFACE

Genesis of This Investigation

Immediately following the terrorist attack on the World Trade Center (WTC) on September 11, 2001, the Federal Emergency Management Agency (FEMA) and the American Society of Civil Engineers began planning a building performance study of the disaster. The week of October 7, as soon as the rescue and search efforts ceased, the Building Performance Study Team went to the site and began its assessment. This was to be a brief effort, as the study team consisted of experts who largely volunteered their time away from their other professional commitments. The Building Performance Study Team issued its report in May 2002, fulfilling its goal "to determine probable failure mechanisms and to identify areas of future investigation that could lead to practical measures for improving the damage resistance of buildings against such unforeseen events."

On August 21, 2002, with funding from the U.S. Congress through FEMA, the National Institute of Standards and Technology (NIST) announced its building and fire safety investigation of the WTC disaster. On October 1, 2002, the National Construction Safety Team Act (Public Law 107-231), was signed into law. The NIST WTC Investigation was conducted under the authority of the National Construction Safety Team Act.

The goals of the investigation of the WTC disaster were:

- To investigate the building construction, the materials used, and the technical conditions that contributed to the outcome of the WTC disaster.
- To serve as the basis for:
  - Improvements in the way buildings are designed, constructed, maintained, and used;
  - Improved tools and guidance for industry and safety officials;
  - Recommended revisions to current codes, standards, and practices; and
  - Improved public safety.

The specific objectives were:

1. Determine why and how WTC 1 and WTC 2 collapsed following the initial impacts of the aircraft and why and how WTC 7 collapsed;
2. Determine why the injuries and fatalities were so high or low depending on location, including all technical aspects of fire protection, occupant behavior, evacuation, and emergency response;
3. Determine what procedures and practices were used in the design, construction, operation, and maintenance of WTC 1, 2, and 7; and
4. Identify, as specifically as possible, areas in current building and fire codes, standards, and practices that warrant revision.

NIST is a nonregulatory agency of the U.S. Department of Commerce's Technology Administration. The purpose of NIST investigations is to improve the safety and structural integrity of buildings in the United States, and the focus is on fact finding. NIST investigative teams are authorized to assess building performance and emergency response and evacuation procedures in the wake of any building failure that has resulted in substantial loss of life or that posed significant potential of substantial loss of life. NIST does not have the statutory authority to make findings of fault nor negligence by individuals or organizations. Further, no part of any report resulting from a NIST investigation into a building failure or from an investigation under the National Construction Safety Team Act may be used in any suit or action for damages arising out of any matter mentioned in such report (15 USC 281a, as amended by Public Law 107-231).

Organization of the Investigation

The National Construction Safety Team for this Investigation, appointed by the then NIST Director, Dr. Arden L. Bement, Jr., was led by Dr. S. Shyam Sunder. Dr. William L. Grosshandler served as Associate Lead Investigator, Mr. Stephen A. Cauffman served as Program Manager for Administration, and Mr. Harold E. Nelson served on the team as a private sector expert. The Investigation included eight interdependent projects whose leaders comprised the remainder of the team. A detailed description of each of these eight projects is available at http://wtc.nist.gov. The purpose of each project is summarized in Table P–1, and the key interdependencies among the projects are illustrated in Fig. P–1.

Table P–1. Federal building and fire safety investigation of the WTC disaster.

Technical Area and Project Leader	Project Purpose
Analysis of Building and Fire Codes and Practices; Project Leaders: Dr. H. S. Lew and Mr. Richard W. Bukowski	Document and analyze the code provisions, procedures, and practices used in the design, construction, operation, and maintenance of the structural, passive fire protection, and emergency access and evacuation systems of WTC 1, 2, and 7.
Baseline Structural Performance and Aircraft Impact Damage Analysis; Project Leader: Dr. Fahim H. Sadek	Analyze the baseline performance of WTC 1 and WTC 2 under design, service, and abnormal loads, and aircraft impact damage on the structural, fire protection, and egress systems.
Mechanical and Metallurgical Analysis of Structural Steel; Project Leader: Dr. Frank W. Gayle	Determine and analyze the mechanical and metallurgical properties and quality of steel, weldments, and connections from steel recovered from WTC 1, 2, and 7.
Investigation of Active Fire Protection Systems; Project Leader: Dr. David D. Evans; Dr. William Grosshandler	Investigate the performance of the active fire protection systems in WTC 1, 2, and 7 and their role in fire control, emergency response, and fate of occupants and responders.
Reconstruction of Thermal and Tenability Environment; Project Leader: Dr. Richard G. Gann	Reconstruct the time-evolving temperature, thermal environment, and smoke movement in WTC 1, 2, and 7 for use in evaluating the structural performance of the buildings and behavior and fate of occupants and responders.
Structural Fire Response and Collapse Analysis; Project Leaders: Dr. John L. Gross and Dr. Therese P. McAllister	Analyze the response of the WTC towers to fires with and without aircraft damage, the response of WTC 7 in fires, the performance of composite steel-trussed floor systems, and determine the most probable structural collapse sequence for WTC 1, 2, and 7.
Occupant Behavior, Egress, and Emergency Communications; Project Leader: Mr. Jason D. Averill	Analyze the behavior and fate of occupants and responders, both those who survived and those who did not, and the performance of the evacuation system.
Emergency Response Technologies and Guidelines; Project Leader: Mr. J. Randall Lawson	Document the activities of the emergency responders from the time of the terrorist attacks on WTC 1 and WTC 2 until the collapse of WTC 7, including practices followed and technologies used.

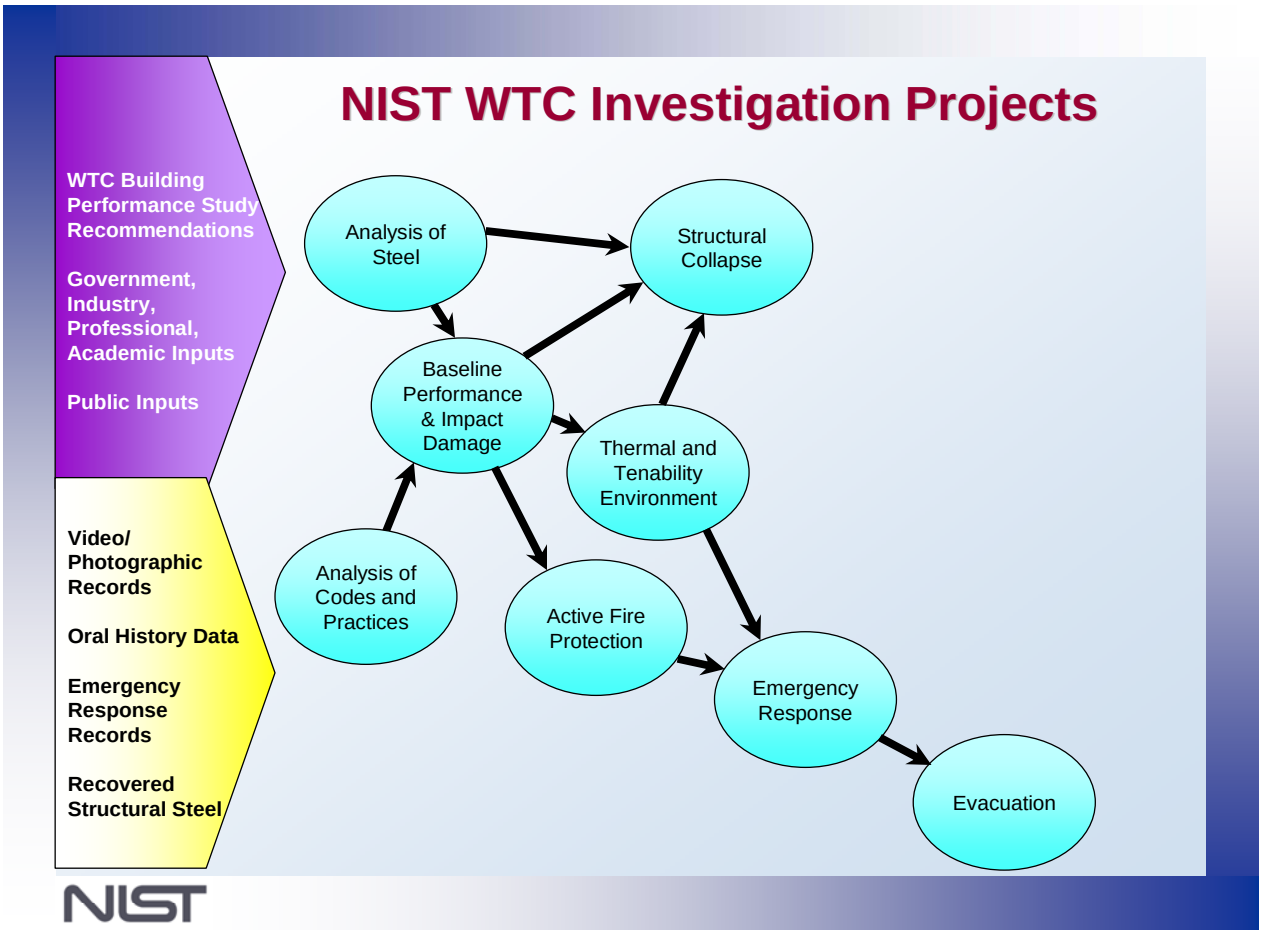

Figure P–1. The eight projects in the federal building and fire safety investigation of the WTC disaster.

National Construction Safety Team Advisory Committee

The NIST Director also established an advisory committee as mandated under the National Construction Safety Team Act. The initial members of the committee were appointed following a public solicitation. These were:

- Paul Fitzgerald, Executive Vice President (retired) FM Global, National Construction Safety Team Advisory Committee Chair
- John Barsom, President, Barsom Consulting, Ltd.
- John Bryan, Professor Emeritus, University of Maryland
- David Collins, President, The Preview Group, Inc.
- Glenn Corbett, Professor, John Jay College of Criminal Justice
- Philip DiNenno, President, Hughes Associates, Inc.

- Robert Hanson, Professor Emeritus, University of Michigan
- Charles Thornton, Co-Chairman and Managing Principal, The Thornton-Tomasetti Group, Inc.
- Kathleen Tierney, Director, Natural Hazards Research and Applications Information Center, University of Colorado at Boulder
- Forman Williams, Director, Center for Energy Research, University of California at San Diego

This National Construction Safety Team Advisory Committee provided technical advice during the Investigation and commentary on drafts of the Investigation reports prior to their public release. NIST has benefited from the work of many people in the preparation of these reports, including the National Construction Safety Team Advisory Committee. The content of the reports and recommendations, however, are solely the responsibility of NIST.

Public Outreach

During the course of this Investigation, NIST held public briefings and meetings (listed in Table P–2) to solicit input from the public, present preliminary findings, and obtain comments on the direction and progress of the Investigation from the public and the Advisory Committee.

NIST maintained a publicly accessible Web site during this Investigation at http://wtc.nist.gov. The site contained extensive information on the background and progress of the Investigation.

NIST's WTC Public-Private Response Plan

The collapse of the WTC buildings has led to broad reexamination of how tall buildings are designed, constructed, maintained, and used, especially with regard to major events such as fires, natural disasters, and terrorist attacks. Reflecting the enhanced interest in effecting necessary change, NIST, with support from Congress and the Administration, has put in place a program, the goal of which is to develop and implement the standards, technology, and practices needed for cost-effective improvements to the safety and security of buildings and building occupants, including evacuation, emergency response procedures, and threat mitigation.

The strategy to meet this goal is a three-part NIST-led public-private response program that includes:

- A federal building and fire safety investigation to study the most probable factors that contributed to post-aircraft impact collapse of the WTC towers and the 47-story WTC 7 building, and the associated evacuation and emergency response experience.
- A research and development (R&D) program to (a) facilitate the implementation of recommendations resulting from the WTC Investigation, and (b) provide the technical basis for cost-effective improvements to national building and fire codes, standards, and practices that enhance the safety of buildings, their occupants, and emergency responders.

Table P–2. Public meetings and briefings of the WTC Investigation.

Date	Location	Principal Agenda
June 24, 2002	New York City, NY	Public meeting: Public comments on the *Draft Plan* for the pending WTC Investigation.
August 21, 2002	Gaithersburg, MD	Media briefing announcing the formal start of the Investigation.
December 9, 2002	Washington, DC	Media briefing on release of the *Public Update* and NIST request for photographs and videos.
April 8, 2003	New York City, NY	Joint public forum with Columbia University on first-person interviews.
April 29–30, 2003	Gaithersburg, MD	NCST Advisory Committee meeting on plan for and progress on WTC Investigation with a public comment session.
May 7, 2003	New York City, NY	Media briefing on release of *May 2003 Progress Report.*
August 26–27, 2003	Gaithersburg, MD	NCST Advisory Committee meeting on status of the WTC investigation with a public comment session.
September 17, 2003	New York City, NY	Media and public briefing on initiation of first-person data collection projects.
December 2–3, 2003	Gaithersburg, MD	NCST Advisory Committee meeting on status and initial results and release of the *Public Update* with a public comment session.
February 12, 2004	New York City, NY	Public meeting on progress and preliminary findings with public comments on issues to be considered in formulating final recommendations.
June 18, 2004	New York City, NY	Media/public briefing on release of *June 2004 Progress Report.*
June 22–23, 2004	Gaithersburg, MD	NCST Advisory Committee meeting on the status of and preliminary findings from the WTC Investigation with a public comment session.
August 24, 2004	Northbrook, IL	Public viewing of standard fire resistance test of WTC floor system at Underwriters Laboratories, Inc.
October 19–20, 2004	Gaithersburg, MD	NCST Advisory Committee meeting on status and near complete set of preliminary findings with a public comment session.
November 22, 2004	Gaithersburg, MD	NCST Advisory Committee discussion on draft annual report to Congress, a public comment session, and a closed session to discuss pre-draft recommendations for WTC Investigation.
April 5, 2005	New York City, NY	Media and public briefing on release of the probable collapse sequence for the WTC towers and draft reports for the projects on codes and practices, evacuation, and emergency response.
June 23, 2005	New York City, NY	Media and public briefing on release of all draft reports for the WTC towers and draft recommendations for public comment.
September 12–13, 2005	Gaithersburg, MD	NCST Advisory Committee meeting on disposition of public comments and update to draft reports for the WTC towers.
September 13–15, 2005	Gaithersburg, MD	WTC Technical Conference for stakeholders and technical community for dissemination of findings and recommendations and opportunity for public to make technical comments.

- A dissemination and technical assistance program (DTAP) to (a) engage leaders of the construction and building community in ensuring timely adoption and widespread use of proposed changes to practices, standards, and codes resulting from the WTC Investigation and the R&D program, and (b) provide practical guidance and tools to better prepare facility owners, contractors, architects, engineers, emergency responders, and regulatory authorities to respond to future disasters.

The desired outcomes are to make buildings, occupants, and first responders safer in future disaster events.

National Construction Safety Team Reports on the WTC Investigation

A final report on the collapse of the WTC towers is being issued as NIST NCSTAR 1. A companion report on the collapse of WTC 7 is being issued as NIST NCSTAR 1A. The present report is one of a set that provides more detailed documentation of the Investigation findings and the means by which these technical results were achieved. As such, it is part of the archival record of this Investigation. The titles of the full set of Investigation publications are:

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EXECUTIVE SUMMARY

E.1 PURPOSE AND SCOPE

This effort builds upon work already done by The Fire Department of the City of New York (FDNY), The New York City Police Department (NYPD), and McKinsey & Company by:

- fully documenting what happened during the response by the fire service and other emergency responders to the attacks on the World Trade Center (WTC), up to the time of collapse of WTC 7
- identifying issues that need to be addressed in changes to practice, standards, and codes

It goes substantially beyond the work previously done by others.

Task 1. Collect emergency response data to document emergency responder fatalities, command and control procedures, and equipment performance. Records of interest included dispatch logs, recorded radio communications, run logs from surviving responding units, 9-1-1 records, data recorded by The Port Authority of New York and New Jersey (PANYNJ or Port Authority) operations, FDNY, NYPD, and fire ground positioning of emergency apparatus. Information was collected on operations and functions of communication systems, on-site emergency information systems, fire alarm panels, elevator control panels, standpipes and fire hoses, and other pre-positioned emergency equipment. In coordination with project seven, oral history data was collected from witnesses, those in control of emergency operations, and surviving emergency responders to the extent their oral history had not already been documented. Technical experts reviewed and conducted a fact-based analysis of the data.

Task 2. Interpret the factual analysis to determine the effect on responder successes of factors such as:

- the influence of building design (e.g., height, stairways, elevators, smoke control systems) on fire service command and control procedures, life saving operations, and safety of emergency responders;
- the influence of aircraft impact damage and fuel run-off on fire service command and control procedures, life saving operations, and safety of emergency responders;
- the impact of systems failures (e.g., communication systems, water supply, sprinklers, standpipes) on fire service command and control procedures, life saving operations, and safety of emergency responders;
- building occupant egress as related to emergency responder operations;
- the ability to fight large fires on the upper floors of tall buildings;
- the impact that the 1993 bombing of the WTC had on codes, standards, and procedures that affected emergency responders in tall buildings;

- Records and documents generated by the various agencies during operations at the WTC, and
- Records and documents generated following the incident, including investigative reports such as the McKinsey and Company reports for FDNY and NYPD, and records documenting investigative first-person interviews.

Electronic Data

There were two forms of electronic data collected from the three emergency responder departments:

- Radio communication recordings and
- Telephone communication recordings

First-Person Interviews

In October 2003, NIST entered into a three-party agreement between NIST, New York City (NYC), and the National Commission on Terrorist Attacks Upon the United States (the 9/11 Commission). The agreement provided procedures under which NIST and the 9/11 Commission would interview a maximum of 125 NYC emergency responders, 100 from FDNY and 25 from NYPD.

In December 2003, NIST officially requested and the Port Authority agreed to interviews with twelve Port Authority personnel, including emergency responders, safety, security, and management personnel.

The first-person interviews were conducted beginning in December 2003 and were completed in June 2004.

The following represents the number of interviews conducted by NIST with each organization:

- FDNY = 68

  Senior management and officers, mid-level officers, company officers, firefighters, emergency medical personnel, and dispatchers

- NYPD = 25

  Senior management and officers, mid-level officers, emergency service unit personnel, aviation personnel, and dispatchers

- PANYNJ/PAPD = 15

  Senior management personnel, facility safety personnel, building security personnel, facility communication personnel, building vertical transportation personnel, senior PAPD officers, mid-level PAPD officers, and PAPD officers

- OTHER = 8

Interviewees in this group contacted NIST directly or through third parties and indicated that they would like to be interviewed. Approximately half of these individuals were retired FDNY personnel. The group consisted of a building security guard, building engineers, a dispatcher, firefighters, and a fire safety director.

- Total Interviews = 116

Visual Data

- Photographs, film, and digital;
- Motion images, video clips, and movie film

Dr. William Pitts of NIST and his staff acquired a large amount of the visual data. Numerous photographs and video records were acquired from FDNY and NYPD. Uncut video was acquired from the Naudet brothers' documentary and video news organizations. Thousands of photographs and video clips were obtained from the PANYNJ and other New York City sources, including the media and the public.

E.2 ANALYSIS AND FINDINGS

Changes Made by the PANYNJ Following the February 1993 WTC Bombing

After the February 1993 bombing, the following changes were made at the World Trade Center by the PANYNJ that had a direct impact on emergency responder operations on September 11, 2001:

- Work on the installation of automatic sprinkler systems was accelerated. The installation of automatic sprinkler systems began prior to 1993 and involved WTC 1 and WTC 2.
- Improvements were made to the Concourse level of the WTC to improve egress.
- A new Port Authority Police Command Center was established inside WTC 5.
- Fire Command Desks were installed in the lobbies of WTC 1 and WTC 2.
- A radio repeater (radio repeater: an electronic device for amplifying and retransmitting a radio signal) was installed in WTC 5 that operated on the FDNY city-wide high-rise frequency. The antenna was located on the top of WTC 5 and was directed at WTC 1 and WTC 2. Controls for operating the repeater were originally located at the PAPD Police Command Center inside WTC 5. During the spring of 2001, controls for repeater operation were moved to the Fire Command Desks inside the lobby of each of the two towers, at the request of FDNY.
- The elevator intercom system was upgraded and could be monitored at the Lobby Fire Command Desk in each tower.

- A new Operations Control Center with the capability to monitor all HVAC systems and elevators was constructed on the B1 level of WTC 2.

- Multiple power sources were installed for exit stairway lighting in the towers.

- WTC 1 and WTC 2 received a new decentralized Fire Alarm System, Class E (Style 7), with three separate data risers to transponders located every three floors, with redundant control panels and electronics, and multiple control station announcement capability.

- Fire drills were conducted in conjunction with FDNY.

Changes Made by FDNY Following the February 1993 WTC Bombing

Incident Command System: The scope of the February 1993 bombing was beyond anything ever experienced by FDNY, and information overload occurred at the incident command level. Tasks to resolve issues related to the 1993 bombing were delegated along the lines of the FDNY incident command system in the following areas: command, planning, operations, logistics, and finance. It was also recognized that all agencies must be sensitive to and coordinate operations for effective incident command. The May 1997, Incident Command System manual and its new policies had been in operation with FDNY for approximately four years when the WTC attack occurred on September 11, 2001.

Communications:

- To improve communications at a large incident, the city purchased eighty 800-megahertz radios for use by deputy fire commissioners, each staff chief, and the Field Communications Unit. Twenty of the radios were to be distributed by the Field Communications unit at an incident, if needed.

- A high-rise repeater was requested by FDNY for operations in the WTC, and the Port Authority installed it in WTC 5.

- FDNY companies that were located near the WTC and often responded to the WTC were issued Port Authority radios that allowed them to communicate with the building's Deputy Fire Safety Directors and with PAPD.

Interagency Protocols: The New York City Office of Emergency Management (OEM) was established, and it took on the job of promoting the improvement of interagency operations; however, on September 11, 2001, the OEM center located at WTC 7 became ineffective as WTC 7 was evacuated by the emergency response personnel.

Building Systems and Fire Safety Personnel: In 1993, the Port Authority and New York City entered into two Memoranda of Agreement related to fire safety of Port Authority facilities located in New York City. The first agreement allowed for the implementation of fire safety recommendations that would be made by FDNY after they had inspected PANYNJ facilities located in New York City. The second agreement recognized the right of FDNY to conduct fire safety inspections of PANYNJ properties in New York City. It provided guidelines for FDNY to communicate needed corrective actions to the PANYNJ, and it assured that new or modified fire safety systems were to be in compliance with local codes and

regulations. It also required a third party review of the systems by a New York State licensed architect or engineer.

September 11, 2001, Attack on the World Trade Center

Initial "Size-up" and Impact of Aircraft Damage to WTC 1: The first command officer from FDNY to arrive at WTC 1 had actually seen the airplane strike WTC 1. While responding to WTC 1, he radioed Manhattan dispatch to advise them that "a plane had hit the World Trade Center" and that "they have a number of floors on fire." Upon entering WTC 1 and going to the fire command desk to set up the Lobby Command Post, he met with the former building Fire Safety Director and other Port Authority personnel in an effort to determine what damage the building had sustained. During first-person interviews, FDNY personnel provided the following information related to building conditions and emergency response operations in WTC 1:

- It was determined that the elevators were not working and/or were not safe for use; therefore, firefighters would have to gain access to injured and trapped occupants by climbing the stairs and carrying the equipment needed.
- It was likely that the water supply to the stand pipe and automatic sprinkler systems on the upper floors was damaged and that firefighting would not be an option until a reliable water supply was established and equipment was carried up to the fire floors.
- FDNY command personnel learned from 9-1-1 dispatch operators that smoke, fire, and structural damage in the building prevented many building occupants from evacuating floors above the impact zone.
- FDNY command personnel knew that jet fuel had flowed into the elevator shafts and into other parts of the buildings and presented a danger to building occupants and emergency responders.
- Communication systems to the upper floors via Warden Phones and Stand Pipe phones were not working.
- The building communication system used to make emergency announcements to building occupants was not working.

Based on the following facts, the fire chiefs who established the original Command Post inside the lobby of WTC 1 concluded that the fire department efforts should be directed toward evacuation and rescue of building occupants:[1, 2, 3] the impact zone and fires were so high in the building, there were large fires on multiple floors, the building's water supply was compromised, and there were no working elevators that could transport fire fighters and equipment up to a staging area just below the impact zone. Firefighting operations on the upper floors would not have been a reasonable option at that time. The building

[1] FDNY interview 2, winter 2003
[2] FDNY interview 7, winter 2004
[3] FDNY interview 20, winter 2004

conditions indicated that, at best, it would take hours to establish meaningful firefighting operations on the upper floors of the building. The chiefs knew that this assessment did not give much hope for the survival of the people trapped above the fires since the fires would continue to grow and the toxic fire gases would occupy the building spaces where the people were trapped. It was likely that many of the occupants trapped at and above the impact zone would die before help could get to them.

Physiological Impact of Climbing Stairs: All three responding agencies sent personnel up the stairs in both WTC 1 and WTC 2. With the elevators inoperable, all equipment necessary for firefighting, rescue, and treatment of injured occupants had to be carried up the stairs. A normally outfitted FDNY firefighter wearing full protective clothing (coat, pants, helmet, hood, boots, gloves) and Self-Contained Breathing Apparatus (SCBA) carries approximately 23 kg (50 lb) of equipment. Additional equipment, such as radios, lights, extra air bottles, forcible entry equipment, ropes, medical kits, or hose packs and appliances may add another 23 kg (50 lb) or more to the work load. It is not unusual for firefighters to be carrying loads in excess of 46 kg (100 lb) into a building when fighting a fire. The NYPD Emergency Service unit (ESU) and PAPD officers who ascended the stairs also wore SCBA. Much of the equipment they carried was similar to that of the Fire Department. The major difference between the Fire Department and Police Department outfitting was that the Police Department personnel did not wear protective clothing designed for firefighting.

From the time of the first airplane impact into WTC 1 to the collapse of WTC 2, a period of approximately one hour and 12 minutes, emergency responders inside WTC 1 were able to climb to floors in the 40s. However, a small number of emergency responders got to floors in the 40s by taking the only operating elevator to the 16th floor and then using the stairs. A report from one building occupant indicated that they saw firefighters located on floors about in the 50s.[4] (NIST 2004) Within WTC 2, one FDNY Battalion Chief and Ladder Company got to floors in the 70s. They were able to take an elevator from the lobby to the 40th floor before having to walk up the stairs. According to interview information, the consequences of firefighters and other emergency responders having to climb many tens of floors to get to a fire or other high-rise building emergency without the use of elevators are summarized as follows:

- The ability to get both personnel and needed equipment to the desired location is limited by building height.
- Emergency responders wearing police uniforms, not wearing a SCBA or carrying extra equipment, were able to climb the stairs at a rate of approximately 1.4 minutes per floor while climbing to floors in the 40s inside of WTC 1.
- Emergency responders wearing full firefighter turnout gear, wearing a SCBA, and carrying extra equipment were able to climb the stairs at a rate of approximately 2.0 minutes per floor while climbing to floors in the 30s and 40s inside of WTC 1.
- Emergency response time factors related to the rate of fire growth, the ability to rescue building occupants, and the ability to bring a fire under control become more critical with every additional floor in building height.

[4] Interview 1000118 (NIST 2004)

- The ability of emergency responders to climb stairs with equipment and remain physically fit to conduct rescue and firefighting operations, treat injured occupants, and remove them is diminished with every additional floor in building height that must be climbed.

Situational Awareness: Situational awareness was an overriding issue with all emergency responders during operations at the WTC site. First-person interviews with emergency responders from all agencies highlight the importance of situational awareness during this complex emergency response. Results from the interviews showed that there were two basic levels of situational awareness:

1. Emergency responders working outside the buildings, with the ability to observe events and conditions as they changed felt that they had good situational awareness. In addition, emergency responders who worked inside the buildings and had reliable radio communications with people outside the building felt that their situational awareness was good.

2. Emergency responders who worked inside the buildings and had no reliable means of communication other than face-to-face communications felt that they had poor situational awareness.

Some senior emergency responder officers inside WTC 1 felt that their situational awareness was poor even though they were in radio contact with other senior officers outside the building. One of these senior officers stated that *he would have known more about what was going on during the incident if he had been home watching it on TV.*[5]

For emergency responders already inside WTC 1, it took time to confirm that a second aircraft had actually hit WTC 2. A large number of emergency responders working inside WTC 1 realized that something had happened but did not know that a second aircraft struck WTC 2. Some emergency responders who were going up in the stairways inside WTC 1 did not know that anything had happened when the second aircraft struck WTC 2.

Accountability for and Tracking of Emergency Responders: Accountability encompasses the assignment, dispatch, checking in, tracking, locating, and checking out of emergency responders operating at an emergency. With the WTC attack, accountability also involved the recall of emergency responders. Recall refers to bringing emergency responders who are off duty back to duty status. All responding agencies had recall policies in place and did recall personnel for WTC operations. In addition, a few emergency responders self-dispatched to the World Trade Center, and as the recalls were put into effect some emergency responders went to the scene instead of reporting to their assigned location, causing accountability problems at the WTC complex.

All emergency responder organizations had accountability, location, and tracking plans in place, and they generally worked well during the first 30 minutes of WTC operations. However, the FDNY system became overwhelmed with the large number of units and personnel arriving at the scene. FDNY used magnetic Command Boards to keep track of personnel during operations. NYPD kept their personnel and tracking information on a clipboard and paper, and PAPD maintained their accountability and tracking

[5] FDNY interview 7, winter 2004.

information at the PAPD Police Desk inside WTC 5. All emergency responder (FDNY, NYPD, and PAPD) accountability and tracking systems and records were lost when WTC 2 collapsed, and there was no backup for these lost records.

The FDNY Chiefs in charge of the Emergency Medical Services (EMS) operations at the WTC had some difficulties with accountability and tracking of their personnel. The size of the incident, the difficulty in determining early on what EMS units were there, and the self-dispatch of some non-FDNY ambulances added to their difficulties. Not all ambulances operating within New York City are part of the Fire Department. Some respond from hospitals or are from private ambulance companies. One of the biggest problems for the Emergency Medical Services was the lack of control of the ambulances that were not part of the Fire Department.

Location and tracking of personnel is an issue that has been studied by the emergency responder community for many years. Once responders report to a Command Post at the scene of an emergency, receive their assignments, and depart to accomplish their tasks, there is no effective means to locate and track the activities of the units or individuals. On September 11, 2001, the only means for locating and tracking units and personnel was through radio communications. During operations at the WTC, there were so many people using the FDNY radio system for ongoing operations that it became ineffective for locating and tracking personnel.

Emergency Medical Services Patient Tracking: There are many reasons to track patients who are triaged, treated and transported from an emergency. One important reason is to ensure that no one medical facility is overwhelmed by an unexpected influx of patients. The objective is not having an ambulance drop a patient off at a hospital, but at a hospital that has the best capabilities to take care of that person, avoiding situations in which any one hospital is overwhelmed. Within the individual triage and treatment areas that were set up by FDNY, efforts were made to keep track of patients. This was done with pencil and paper. All of the data on patients was lost when the buildings collapsed.

Building Access by Emergency Responders and Evacuation of Civilians by Stairways: During the September 11, 2001, operations, stairs were the primary means of access to and egress from the World Trade Center towers. Elevator service, practically speaking, did not exist in either of the buildings. Of the 99 elevators that were in each tower, only one elevator in each tower was functional and operated in a limited capacity to the lower third of each building. The egress of building occupants in the stairways and through the stairway doors of WTC 1 and WTC 2 generally had a negative impact on the emergency response operations. Emergency responders reported difficulties negotiating the stairway doors and stairways as occupants were coming down. Some of the problems experienced by emergency responders were:

- Difficulty accessing the stairway doors and stairways through the lobby and mezzanine levels because of building occupant flow out of the doorways and stairways; only one person could exit or enter the stairway at a time. If an occupant was leaving through the stairway door that stopped the flow of emergency responders into the stairway. If an emergency responder was entering the stairway through the stairway door that stopped the flow of occupants from leaving the stairway.

- Emergency responder team personnel became separated by the counter flow as building occupants moved down the stairs and the emergency responders attempted to move up.

- Emergency responders experienced difficulty in moving equipment up the stairs as building occupants were coming down the stairs.

Emergency responders interviewed stated that the 1.12 m (44 in)-wide stairways could be easily blocked by one person as they attempted to walk down the stairs. An average-sized person could walk down the center of the stairway and place one hand on each of the staircase handrails. This posture would block the stairway for other people who were trying to move faster down the staircase. This posture was identified as being used by mobility-impaired people who were only able to step down to the next step one foot at a time. This resulted in both feet standing on the same step, instead of the unimpaired gait where one foot is placed onto a step and the other foot is placed on the next step down.

Emergency responders also reported that the stairways became plugged and traffic was stopped as individuals with physical disabilities or obese occupants blocked the stairs.

After WTC 2 collapsed, emergency responders inside WTC 1 attempted to exit the building by going down the various stairways. On the way down, some emergency responders stopped and checked each floor to be sure that it was clear before they proceeded down. On about the 12th floor, FDNY personnel found approximately 40 to 60 people who had been removed from the stairway by others and placed onto the floor because these mobility impaired individuals had been blocking the stairway evacuation routes. The emergency responders stopped and began to assist these people with their evacuation. Depending on the disability or size of the person, it took from one to four emergency responders to assist one person with the evacuation. If the individual being assisted required a lot of assistance or was significantly overweight emergency responders had to change teams as fatigue set in. The evacuation pace while assisting the mobility challenged occupants was often described by the emergency responders as very slow. From the FDNY and PAPD interviews, it was not clear how many of the 40 to 60 occupants were safely evacuated from the building before WTC 1 collapsed. It is known from the interviews that a group of about 20 of these individuals were being moved out of WTC 1 just before the building collapsed.

Communications:

***Building Communications*:** Upon arrival in the lobby of WTC 1, FDNY personnel were told that the building communication systems used to make emergency announcements to building occupants was not working. Communications to the elevators in the upper third of the buildings were lost. The Warden phones did not work, and attempts to use the wire line phones to upstairs were unsuccessful.

- Building occupants reported that the emergency communication system used to make the emergency announcements inside WTC 1 was inoperable as a result of the aircraft impact.

- The emergency communication system used to make the emergency announcements was inoperable as a result of the aircraft impact. FDNY personnel upstairs inside of WTC 1 also learned that the warden phone system was damaged and the standpipe phone system was not operating.

***Radio Communications*:** All of the radio systems analyzed appeared to have been working well during the period of operations just before the attack on the WTC. There were two cases where handie-talkies experienced difficulties with stuck or open microphones just before and during the attack. One of these handie-talkies was used by PAPD, and one was used by NYPD.

High-rise buildings create problems with radio communications. The vast amount of metal and steel reinforced concrete in high-rise buildings is known to attenuate and block radio signals. This problem often occurs with low output power emergency responder handie-talkies. Various documents, including information from the 1993 WTC bombing, highlighted the problems FDNY experienced with radio communications in high-rise buildings. On September 11, 2001, FDNY again experienced poor handie-talkie radio communications within the towers. This had a major impact on FDNY operations particularly inside WTC 1 where no one used the WTC radio repeater system or a Battalion Car Cross Band Repeater. At WTC 2, the FDNY/WTC radio repeater system was used.

***FDNY WTC Radio Repeater*:** The FDNY high-rise Channel 7 repeater that was located in WTC 5 was functional during operations at the WTC. This radio repeater received FDNY radio communications on a specified radio frequency, amplified the signal power, and retransmitted the radio communications on another specified radio frequency that the FDNY radios received. Data suggest that the repeater handset was broken and/or the handset volume was turned down so that it could not be heard when the repeater radio check was conducted. Data also suggest that the repeater's antenna system was not damaged. This is based on the fact that radio communications using the repeater system were carried out inside WTC 1 and inside WTC 2. The communications were recorded by the repeater's recording system; therefore, it is unlikely that the antenna was damaged by debris from the aircraft impact.

The recordings of radio communications by the WTC/FDNY repeater system suggest that operations communications inside WTC 2 were assisted by the repeater. Also, the radio recordings show that communications readability using the repeater was generally good to excellent. Where readability levels were poor, it was generally caused by doubling or multiple people attempting to communicate over the repeater at one time. If FDNY personnel in both towers attempted to use the repeater for operations, there would likely have been additional radio traffic that would have resulted in more unreadable communications. However, it would have been likely that the Lobby Command Post in WTC 1 would have had somewhat improved communications with personnel operating in the upper floors of the building up until the time when WTC 2 collapsed. The radio repeater recordings suggest that the repeater system failed during the collapse of WTC 2.

If the WTC 1 Lobby Command Post had been using the WTC/FDNY repeater system for communications inside the tower, it would have lost the primary means of communications with its personnel, negatively affecting operations. Since the WTC 1 Lobby Command Post was not using the repeater, the apparent repeater failure with the collapse of WTC 2 had no effect on saving lives of FDNY personnel located inside WTC 1. If the repeater had been in use inside WTC 1 when WTC 2 collapsed, it would have taken time to establish that the repeater system had failed, and FDNY personnel would have had to then change radio channels to continue radio communications.

Although the WTC/FDNY repeater was apparently working inside WTC 1, the earlier tests had indicated that it was not working, and emergency responders were informed that it was not working. Therefore, emergency responders did not use the repeater in WTC 1. When the repeater actually did fail, with the collapse of WTC 2, there was no effect on emergency responder communications inside WTC 1, since the repeater was not being used.

***Radio Communications Quantity and Quality*:** All emergency responders struggled with the high volume of radio traffic at the WTC. The surge in radio traffic significantly impacted the quality of radio communications during operations at the WTC. Data for the various departments demonstrate the

significant changes that occurred in radio communications traffic during operations at the WTC. It is evident that PAPD, FDNY, and NYPD all experienced similar surges in radio traffic volume following the first aircraft impact into WTC 1.

Analysis of the radio traffic for each of the departments shows periods where radio traffic rates during the surge conditions potentially resulted in situations where base station radio operators were unable to relay important information.

It is estimated that one-third to one-half of emergency responder radio communications during operations at the WTC on the morning of September 11, 2001, were unreadable or incomplete.

***Radio Communications and Incident Command and Control*:** The poor radio communications at the WTC had a serious impact on the FDNY Command Post's attempts to maintain command and control.

***Radio Communications and Evacuation of Emergency Responders from WTC 1*:** With the collapse of WTC 2, each emergency responder department sent out radio messages calling for the immediate evacuation of WTC 1. At least three FDNY Chief Officers transmitted urgent radio messages over their handie-talkie radios calling for the evacuation of WTC 1. NYPD ESU personnel inside WTC 1 received their orders to evacuate from an ESU Mobilization Point staff person located at Church and Vesey Streets. PAPD command personnel also called for the evacuation of WTC 1.

From first-person interviews with *surviving* emergency responders who went upstairs in WTC 1, eight of the 15 FDNY personnel interviewed who had handie-talkie radios heard the order to evacuate over their radios. All three NYPD ESU officers interviewed heard the order to evacuate over their radios. Of the three PAPD officers interviewed, two heard the order to evacuate over their radios, and one did not.

Radio communications associated with the order to evacuate WTC 1 had mixed results after the collapse of WTC 2. Data show that some heard the evacuation orders while other personnel on the same floor did not hear the orders. Lack of timely information sharing and inadequate communications capabilities likely contributed to the loss of emergency responder lives.

Coordination of Response Activities with Other Authorities at the World Trade Center: In general, on the morning of September 11, 2001, all departments attempted to work together to save as many lives as possible and protect the citizens of New York City. At the same time, first-person interviews with FDNY and NYPD personnel showed that at times some issues related to a given department's operational responsibility and the competitive nature of departments did exist. However, emergency responder interviews also suggest that inter-agency competition had minimal effect on operations at the WTC before the towers collapsed.

The Office of Emergency Management (OEM) was established in New York City after the 1993 bombing, in part, to promote unified operations between and among the various city emergency responder departments. On the morning of September 11, 2001, OEM operations were disrupted with the loss of the city's OEM operations center located inside WTC 7. Since the OEM center was not available for operations, NYPD, FDNY, and OEM Commissioners met the Mayor on the street with the group initially assembling at Barclay Street. At the same time, NYPD was establishing an alternate command center for the Mayor and his staff at 75 Barclay Street so that he and his staff could oversee operations. (Giuliani 2002). However, their operations from 75 Barclay Street were disrupted by the collapse of the

towers, and they had to quickly evacuate from that site. Data show that there was no formal structure of unified command between departments below the Mayor and Commissioner level of operations. FDNY and NYPD department chiefs were not working together at the same command post, and they did not formulate unified orders or directions for their departments.

NYPD generally has different responsibilities from FDNY related to security, traffic control, protection of the public and the crime scene, etc. However, there were overlapping functions with NYPD ESU rescue team operations inside and around the WTC towers and FDNY operations. Although ESU rescue teams eventually joined and worked with FDNY personnel, functional unified operations were diminished as a result of the two departments' command posts being separated. In addition, the separate command posts could not communicate with each other on their different radio systems, and neither FDNY nor NYPD had liaison officers working with the other department's command post until after WTC 1 collapsed.

The coordination of communications and operations between the responding authorities at the WTC was a challenge for all emergency responders working that morning. The short time frame related to the attack and emergency responder operations coupled with successive significant threats requiring response (an aircraft hitting WTC 2 after WTC 1 was hit, the possible threat of a third aircraft coming in, the collapse of WTC 2, etc.) compounded the difficulty of establishing a unified operation. The challenges related to the establishment of unified operations were made significantly worse when the OEM facility located inside WTC 7 had to be evacuated. Although there was merit to having the FDNY and NYPD Command Posts separated, there was no uniform means for communicating between the two Command Posts at the time when WTC 2 collapsed. FDNY and NYPD primarily operated as independent organizations based on their operational responsibilities. However, FDNY, EMS, NYPD, PAPD, PANYNJ, and OEM attempted to work together. These attempts to work together were stymied by a lack of existing protocols that clearly defined authorities and responsibilities, communications systems problems, and multiple major attacks and threats.

Emergency Responder/News Media Communications: Evaluation of emergency responder/news media operations indicates that communications between the organizations was less than totally effective. Critical information related to life safety and evacuation from the WTC towers was not transmitted to the news media so that it could be broadcast to people threatened by the attack and building fires. At times, news media inquiries interfered with emergency responders as they attempted to carryout life safety operations. Appropriate emergency response agency contact points were bypassed or not used by some news media for gathering information. It appears that emergency response agencies were overwhelmed by news media requests for information.

Emergency Response Issues

***Preplanning*:** Preplanning is an integral part of all emergency response operations. Building owners and operators, fire departments, emergency medical services, and police departments need pre-plans that address safety issues associated with potentially high risk properties like the WTC. Not only do these groups need to develop pre-plans for emergencies in high-rise buildings, they need to be sure that each of the pre-plans appropriately link to form a cohesive and functional unified plan. The 1993 attack on the WTC heightened FDNY's awareness of the need for preplanning and command organization that went beyond the scale of operations carried out during the 1993 bombing. Even with their preplanning, many

of the same difficulties experienced during the 1993 bombing were evident during the September 11, 2001, emergency response to the WTC. Some of these were:

- Poor radio communication inside the buildings and its effect on command and control.
- Emergency responders indicated that the buildings were inadequately marked, and many emergency responders did not know one building from the other. This resulted in units being assigned to one building and reporting to the other building without knowing that it was the wrong building.
- Emergency responder units that did not normally work in the lower Manhattan area were not aware of the buildings' design and construction and did not have information concerning the buildings' operating systems.
- Management of ambulance and other emergency apparatus access and exit from the site.
- Difficulties establishing a unified command system.

***Access and Firefighting*:**

- Physiological impact on emergency responders climbing more than 10 to 12 floors during an emergency.
- Adequacy of building capacity for egress and firefighting access during full evacuation of fully occupied tall buildings. Access to high-rise buildings by emergency responders is hindered by counterflow, egress capacity, and lack of available elevators.
- Distance (i.e., remoteness) between stairwells where standpipes are located, redundant standpipe and water supply systems.
- Time factors associated with: structural fire resistance vs. firefighting/rescue operations

***Emergency Communications*:**

- Lack of rigorous pre-emergency inspection and testing of radio communications systems within high-rise buildings to identify performance gaps and inadequacies.
- Performance requirements for emergency communication systems in buildings.
  - Design, testing, certification standards
  - Maintenance and inspection requirements
- Lack of communications network architecture (interoperability) and operational protocols for intra- and inter-agency communication at all levels of organizational hierarchy. This includes:

- Scalability in terms of the number of emergency responders using the system and providing radio coverage in large buildings with challenging radio frequency propagation environments
- Interoperability with existing legacy emergency communication systems
- Localization techniques to identify emergency responders within indoor building environments
- Conventional two-way systems versus wireless network systems

***Command and Control*:** On September 11, 2001, command and control was seriously affected by the lack of effective communications. In addition, the system used for maintaining records of unit assignments at each command post was not capable of managing the numbers of units and personnel being assigned to operate at the WTC. The following are key issues related to Command and Control:

- Availability of detailed procedures and methods for gathering, processing, and delivering situational information (including voice, video, and data integration) to all emergency responders, including 9-1-1 operators, wardens, incident commander, etc.
- Availability of effective codes and protocols for establishment and uninterrupted operation of the incident command and control system, and for preservation and dissemination of information managed by command posts.
  - Command posts established within the collapse zone of buildings that received serious impact damage and contained large multi-floor fires
  - Establishing the command post prior to the request and dispatch of units in excess of the initial alarm assignments (the ability to keep track of personnel before they are sent in.)
  - Effects of self-dispatch and freelancing of emergency responders and ambulances, especially teams lacking protective clothing and medical equipment
  - Robustness of assignment and tracking (accountability) system for large-scale emergencies
- Communication of the overall command strategy to all responders relative to conducting only rescue and evacuation operations below the fire floors.
- Secure location of state and local Emergency Operation Centers.
- Rapid adoption and execution of a unified emergency response mission by all emergency responder ranks
- The dispatch of large numbers of personnel and apparatus and the ability of management to maintain accountability in a timely manner. Additionally, the ability of the incident site to effectively accommodate large numbers of personnel and apparatus.

E.3 REFERENCES

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Chapter 1
INTRODUCTION

On the morning of September 11, 2001, two hijacked aircraft were deliberately crashed into the World Trade Center (WTC) towers in lower Manhattan, New York City. Approximately 17,600 people, representing nations from around the world, were inside the buildings as the attack occurred. This attack caused a greater loss of human life than the December 7, 1941 attack on Pearl Harbor. The two aircraft striking the World Trade Center towers resulted in the deaths of 2,749 people. Many of these people died at the moment of aircraft impact, hundreds of building occupants were trapped in the buildings above the impact zones, and thousands were forced to escape from the buildings.

New York City emergency responders rushed to the scene in hope of saving human lives, and as a result, hundreds of emergency responders gave their lives when the buildings collapsed. A total of 343 Fire Department of the City of New York (FDNY) personnel were lost; 37 Port Authority Police Department (PAPD) officers plus one K-9 member, and 23 New York City Police Department (NYPD) personnel were lost, for a total of 421 emergency response personnel. In addition, there was one employee of the Federal Bureau of Investigation, one employee of the Untied States Secret Service, one Fire Patrolman, and 15 other ambulance and volunteer emergency responder personnel who sacrificed their lives that morning.

The names of all emergency responders who gave the ultimate sacrifice on September 11, 2001, are listed in Attachment 1 at the end of this report.

Many of these emergency responder fatalities occurred outside of the WTC towers; data from FDNY shows that approximately 160 of the 343 personnel were lost outside the towers. In addition, it is believed that all of the 15 volunteer responders were lost outside of the towers. The human toll was not just in lives lost; there were approximately 2,000 emergency responders injured as a result of the attack on the WTC towers.

As emergency responders began operations at WTC 1, they were faced with extraordinary conditions with hundreds of seriously injured, burned, and dying citizens at the scene. As they worked, the second aircraft came from the south and crashed into WTC 2, producing a large fireball and spreading burning fuel around the complex. In addition, thousands of aircraft and building fragments fell from the sky and struck people and equipment on the ground. Human bodies from the aircraft and buildings fell to the streets as a result of the aircraft impact. Even after the aircraft attack was finished emergency responders had to negotiate extremely dangerous conditions as they attempted to access the WTC towers. Falling building materials, glass, flaming debris, people falling and people deliberately jumping from the buildings and falling into the streets and plaza created an extremely dangerous zone around the buildings as emergency responders attempted to help those in need. The first FDNY member killed that morning was hit by a falling person. Many of the emergency responders at the WTC site indicated that they felt they were conducting rescue operations in a war zone.

This report describes the purpose of the NIST emergency response investigative effort, the methods used during the investigation, the analysis of evidence from the investigation, and findings that address the advancement of emergency responder operations and safety.

1.1 PURPOSE

The emergency response investigative effort focused on the following:

- fully document what happened during the response by the fire service to the attacks on the World Trade Center, up to the time of collapse of WTC 7
- identify issues that need to be addressed in changes to practice, standards and codes
- identify alternative practices and/or technologies that may address these issues
- identify R&D needs that advance the safety of the fire service in responding to massive fires in tall buildings.

1.2 TECHNICAL APPROACH

Project 8 was divided into four tasks as follows:

Task 1. Collect emergency response data in cooperation with FDNY, NYPD, and The Port Authority of New York and New Jersey (PANYNJ or Port Authority) to document emergency responder fatalities, command and control procedures, and equipment performance. Records of interest included dispatch logs, recorded radio communications, run logs from surviving responding units, 9-1-1 records, data recorded by the FDNY, the PANYNJ operations, and the NYPD, and fire ground positioning of emergency apparatus. Information also was sought on operations and function of communications systems, on-site emergency information systems, fire alarm panels, elevator control panels, standpipes and fire hoses, and other pre-positioned emergency equipment. In coordination with the NIST analysis of the occupant behavior, egress, and emergency communication (refer to NIST NCSTAR 1-7[1]), oral history data were collected from witnesses, those in control of emergency operations, and surviving emergency responders to the extent that their oral history had not already been documented. This effort also used the FDNY and NYPD McKinsey & Company[2,3] reports as one source of preliminary investigative information. Technical experts reviewed and conducted a fact-based analysis of the data.

[1] This reference is to one of the companion documents from this Investigation. A list of these documents appears in the Preface to this report.

[2] McKinsey & Company, Increasing FDNY's Preparedness, Fire Department of the City of New York, August 19, 2002.

[3] McKinsey & Company, Improving NYPD Emergency Preparedness and Response, New York City Police Department, August 19, 2002.

Task 2. Interpret the factual data to determine the effect on responder successes of factors such as:

- the influence of building design (e.g., height, stairways, elevators, smoke control systems) on fire service command and control procedures, life saving operations, and safety of rescue personnel;
- the influence of aircraft impact damage and fuel run-off on fire service command and control procedures, life saving operations, and safety of rescue personnel;
- the impact of systems failures (e.g., communications systems, water supply, automatic sprinklers, standpipes) on fire service command and control procedures, life saving operations, and safety of rescue personnel;
- building occupant egress as related to fire service operations;
- the ability to fight large fires on the upper floors of tall buildings;
- the impact that the 1993 bombing of the WTC had on codes, standards, and procedures that affected emergency responders in tall buildings;
- pre-planning, training, and standard operating procedures (including command and control) at the time of the WTC attack;
- firefighter accountability, location, and tracking,
- fire and emergency response protocols for tall buildings;
- the resources available for initial situational assessment and incident management, and practices for determining the possibility of structural collapse; and
- communications and coordination of response activities with other authorities at the WTC.

Task 3. Identify alternative emergency response practices and technologies that may advance the safety and effectiveness of emergency responders, such as: knowledge/information systems for command and control decisions; elevator use by firefighters; firefighter tracking systems; interoperability of communication systems (occupants, firefighters, police, EMS); fire growth and smoke hazard prediction; structural safety monitoring, assessment, and prediction; and simulation tools for training.

Task 4. Report preparation: The results of this project synthesized into this report describe the actions of the fire service and performance of their equipment; identify available alternatives related to fire service technology, training, and operational procedures; and identify R&D needs in support of their capability to protect the public, themselves, and vital physical infrastructure during extreme events.

During the course of this investigation, the Project 8 staff interacted with the staff of other projects within the NIST WTC Investigation (see Figure 1–1 below). Information gained from interviews and radio/telephone recordings was shared, most notably with the following projects.

- Project 1. Analysis of Building and Fire Codes and Practices. Information regarding the built environment and how it impacted emergency responders. Information such as the effects of elevator usability on emergency responders, and the effects of stairway width and door widths on emergency responders in accessing the upper floors.

- Project 4. Investigation of Active Fire Protection Systems. Reports of any systems that were used by emergency responders or activated before their arrival.

- Project 5. Reconstruction of Thermal and Tenability Environment. Information from emergency responders on conditions in stairwells and other areas of the towers and WTC 7.

- Project 6. Structural Fire Response and Collapse Analysis (regarding WTC 7 only). Information from first-person interviews on the damage inflicted on WTC 7 by the collapse of WTC 1 and WTC 2.

- Project 7. Occupant Behavior, Egress and Emergency Communications. Information from both radio recordings and first-person interviews regarding difficulties civilians had descending stairs and evacuating from WTC 1 and WTC 2, emergency communications to civilians regarding the evacuation of the WTC complex, and interaction between emergency responders and civilians.

The implementation of this project is discussed in the remainder of this report.

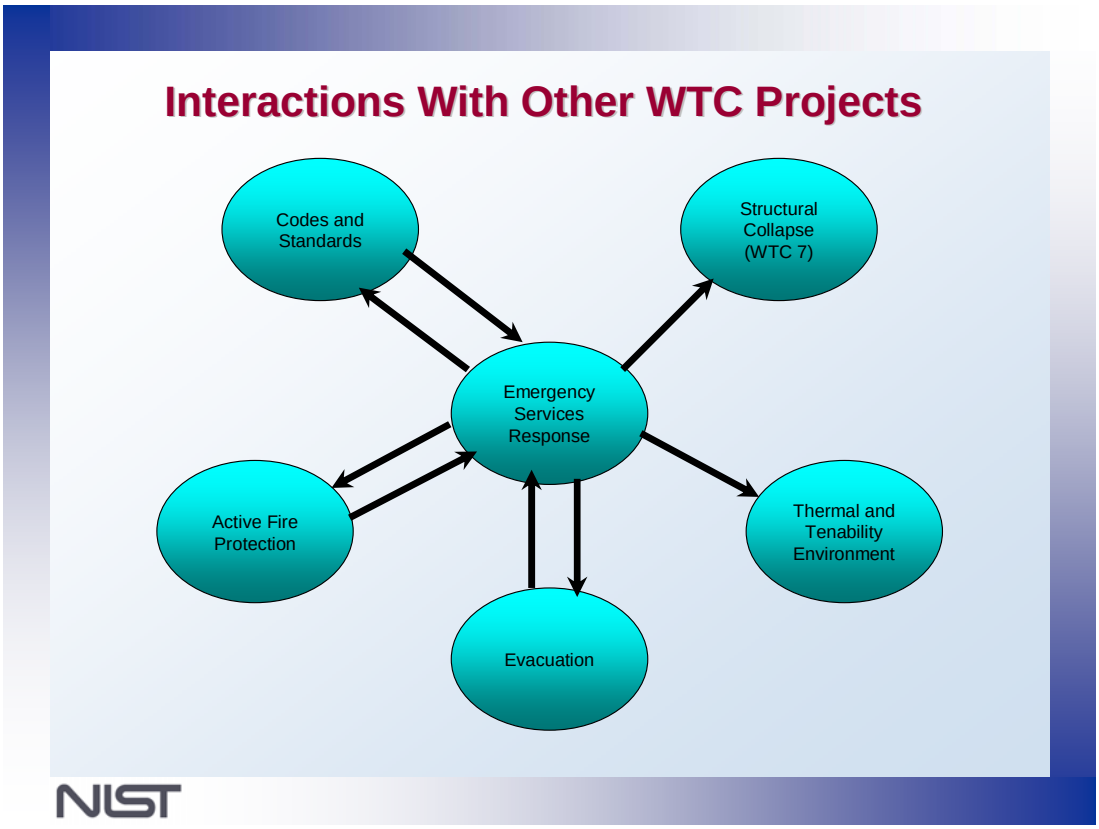

Figure 1–1. Project 8 interactions with other projects within the NIST WTC Investigation.

Chapter 2
COLLECTION OF EMERGENCY RESPONSE DATA

2.1 INTRODUCTION

The attack on the World Trade Center (WTC) generated a massive response from the emergency services departments within New York City, which produced a large amount of information concerning the attack and emergency response. However, in addition to the human losses, a large quantity of valuable information was lost when the building collapsed. The key to performing a valid investigation of emergency response operations during an event of this magnitude is to determine where data can be found and establish a means to acquire the data for analysis. Review of various public records showed that most of the data needed for the investigation were maintained by three organizations that contributed to the emergency response: The Port Authority of New York and New Jersey (PANYNJ or Port Authority), the Fire Department of the City of New York (FDNY), and the New York City Police Department (NYPD). There also was a significant amount of information available through the various media services. The National Institute of Standards and Technology (NIST) collected data for WTC emergency operations, cataloged the data, and filed the data for future analysis. NIST was able to acquire adequate information to support its findings, conclusions, and recommendations regarding the September 11, 2001, emergency response to the WTC attack. The following section discusses the methods used for collecting and preparing the data for analysis.

2.2 METHODOLOGY

Four types of data were identified for use in this investigation: documentary data, electronic data, interview data, and visual data. Each of these data forms can be subdivided into smaller groups.

2.2.1 Documentary Data

Documentary data includes the following:

- policies, protocols, and standards used by the various departments for conducting operations at the WTC,
- records and documents generated during WTC operations by the various departments, and
- records and documents generated following WTC operations, including investigative reports such as the McKinsey and Company reports for FDNY and NYPD, and documentation of investigative first-person interviews.

Data sources were identified using several techniques:

- examination of news media, books, and other materials,
- examination of public comments received by NIST,

- meetings with each of the three organizations listed above,
- first-person interviews, and
- discussion with emergency responder experts.

Data sources were identified using "lead following" methodologies. In the context of this report, lead following describes the process of gathering information and determining the facts, and using the facts to provide leads for identifying additional information that is needed. As the data sources were identified, written requests were made to each agency identified as possessing the data. The requests were followed by meetings and discussions that formalized agreements setting forth rules for the transfer and protection of the data. After the agreements were executed, the data were transferred to NIST or NIST investigation staff accessed the data at agreed upon locations. Approximately half of the data requested were transferred to NIST and were entered into the investigation's files. The other half of the data was studied in the New York City area.

A large quantity of documentary and electronic data was transferred to NIST from the PANYNJ. This included files related to lists of deceased personnel, building operations, fire protection systems, alarm systems, elevator systems, emergency practices and protocols, communications transcripts, summaries of personal accounts during emergency operations, descriptions of the radio communications systems in the WTC towers and sub-grade levels (including the FDNY high-rise radio repeater), and copies of the actual radio and telephone communications that occurred during WTC emergency operations.

FDNY transferred the following documents to NIST: copies of the FDNY McKinsey and Company report and supporting documents, documents identifying deceased personnel, lists of personnel injured during the attack, lists of all known personnel that responded to the WTC, documents on high-rise firefighter training and department practices and protocols, dispatch records, company reports for units responding to the WTC, details on radio communications systems and operations, an audio tape of FDNY radio communications just prior to the attack on the World Trade Center, and documents concerning the 1993 attack on the World Trade Center. NIST reviewed the following data in New York City: transcripts of 500 interviews conducted by FDNY following the attack, and radio communications for FDNY Manhattan dispatch, Brooklyn dispatch, and FDNY City-wide communications.

NYPD transferred the following documents to NIST: copies of the NYPD McKinsey and Company report and supporting documents, documents identifying deceased personnel, information on injuries to NYPD personnel, information on aviation rescue, and copies of audio recordings of the NYPD Special Operations Division, Division 1, and NYPD City-wide radio communications that took place during emergency operations at the WTC.

As the data were gathered, they were cataloged and filed for use. Records were accessed as needed depending upon the part of the investigation that was being studied. When work on the documents was completed, the documents were returned to the investigation file system.

2.2.2 Electronic Data

There were two forms of electronic data collected from the three emergency responder departments:

- radio communications recordings, and
- telephone communications recordings.

The electronic data files were processed and transcribed using methods described in the following section.

Audio Data Files and Processing

An evaluation of methods for listening to the recorded communications files was carried out. Comparisons were made between the functionality of using tape recorders versus that of using digital computer-based software for listening to the various emergency response communications files. It became apparent that the computer based listening system had advantages over the use of tape recorders. Some of the advantages of the computer based system are the ease of operation, ability to use the computer monitor for visually observing the beginning and end of communications periods, and the ability to easily and accurately reverse through a recording to a selected location so that a selected section of a communication could be listened to multiple times. As a result, it was decided to conduct the audio communications study using computer based audio software. This decision had a direct impact on the type of data format and media that would be needed for conducting the audio communications study. Therefore, NIST requested that audio communications be provided in a digital format on CD-ROM disks.

The communications recordings provided by the PANYNJ were digital files that were copied onto CD-ROMs, and they were in a format that could be played by computers while using audio player computer software. The audio recordings on each of the NYPD cassettes had to be converted to a digital format, and each file was then recorded onto a CD-ROM disk. In addition, some of the recordings that were received were recorded at very low amplitude that made it difficult to hear the communications. NIST used audio software to increase the low audio volume recordings to a usable audio level.

An audiotape received from FDNY was unreadable with equipment possessed by NIST. NIST used the Forensic Audio Analysis section of the Federal Bureau of Investigation (FBI) Engineering Research Facility to listen to and copy segments of the tape relevant to the NIST work.

Audio Data Computer Software

Three types of software were used to conduct communications analysis of the audio recordings. Each of these software packages incorporated a clock for timing the audio recording enabling NIST to pinpoint the times of important communications during emergency operations at the WTC.

The first, Sound Forge 6.0, a product of Sonic Foundry, Inc. of Madison, Wisconsin, is a professional digital audio editor (Sonic 2002). It contains tools that can assist with increasing quality and volume of digital audio recordings. It has a graphic output to the computer monitor that allows for rapid evaluation of large audio files. It also is capable of operating as a tool for spectrum analysis. As a spectrum analyzer, it can be used to analyze waveforms by frequency, and it helps to identify noise problems in communications data. In addition, the audio waveforms can be expanded on various scales for detailed

analysis. This software was used throughout the study for analysis of the recordings that required audio adjustments to improve quality.

Initially, NIST prepared two lists of New York City personnel who it wanted to interview, one for FDNY and the other for NYPD.

Since NIST's agreement with NYC indicated that 100 FDNY personnel could be interviewed, the initial list of approximately 200 names took into account the voluntary nature of the interviews and that many people may not have wanted to participate. This list was broken into categories relating to 1) functions carried out by individuals and 2) the locations where people worked during the attack. The names of individuals on the list were placed in the order of importance to the NIST investigation. The list included people who had been identified as working during the attack in senior staff positions, Chief Officers and incident command personnel who worked at the command posts and inside the buildings, radio communications personnel, dispatchers, FDNY personnel who worked at and inside the WTC towers, including Company Officers, firefighters, rescue squad members, and Emergency Medical Service personnel. This list included personnel who were still active with the Fire Department and approximately five FDNY personnel who had retired.

FDNY contacted personnel on the list and asked if they would volunteer to take part in the NIST interviews. As reported to NIST by FDNY, some individuals contacted did not agree to be interviewed, and the department followed up to obtain other interviewees that NIST had identified. As the interview process continued, NIST identified other FDNY personnel that needed to be interviewed and also added additional interviews with Emergency Medical Service personnel. NIST was able to interview personnel from all categories and units that were of interest to the investigation. In all but one case, NIST was able to interview multiple personnel from the categories and units identified. In addition, NIST was able to interview all personnel identified as being critical for understanding the emergency response operations at the WTC. In addition to those on the NIST request list, two FDNY firefighters volunteered and were interviewed by NIST.

For NYPD, NIST prepared a list of personnel divided into categories that included NYPD senior officers, incident command personnel, aviation unit personnel who operated the helicopters during the WTC attack and operations, emergency service unit personnel who worked inside the WTC the towers, and communications personnel. Three of the personnel requested from NYPD did not agree to be interviewed. In addition, as the interviews progressed additional names of people to be interviewed were identified, and NIST made requests to add the new names to the interview list. NIST interviewed personnel who were still employed by NYPD as well as three individuals who had retired.

NIST was able to interview all personnel identified as being critical to understanding the emergency response at the WTC.

Other: The category listed below as "Other" represents individuals who contacted NIST either directly or through third parties and volunteered to be interviewed. Approximately half of the interviewees in this category were retired FDNY personnel. The remaining individuals worked at the WTC on the morning of September 11, 2001, in building security, building engineering, and fire safety jobs. Several of these first-person interviews were conducted over the telephone.

NIST Interview Staff: The NIST interview staff consisted of two primary personnel who have experience with emergency response organizations and operations. One additional interviewer was added as a substitute interviewer. NIST personnel conducted all first-person interviews addressed in this report, and all interviews were conducted in the New York City and New Jersey area. Personnel from the 9/11

Commission participated in all of the emergency responder interviews conducted with employees of New York City (FDNY and NYPD) and the Port Authority. NIST conducted the interviews, which typically lasted from one to three hours, and then the 9/11 Commission personnel would address their questions over a time period of about one-half hour to one hour in length. NIST personnel sat in while the 9/11 Commission personnel asked the interviewees their follow-up questions.

The following represents the actual number of interviews conducted by NIST with each organization:

- FDNY = 68
- NYPD = 25
- PANYNJ/PAPD = 15
- OTHER = 8
- Total Interviews = 116

First-person interviews were conducted with personnel from each of the following categories:

- FDNY: Senior management and officers, mid-level officers, company officers, firefighters, emergency medical personnel, and dispatchers
- NYPD: Senior management and officers, mid-level officers, Emergency Service Unit personnel, aviation personnel, and dispatchers
- PANYNJ/PAPD: Senior management personnel, facility safety personnel, building security personnel, facility communications personnel, building vertical transportation personnel, senior PAPD officers, mid-level PAPD officers, and line PAPD officers
- OTHER: A building security guard, dispatcher, firefighters, WTC building engineer, and a fire safety director

Each interview generally took from one to four hours to complete (including time when questioning was conducted by the 9/11 Commission staff), depending on the person's job and the complexity of their involvement in emergency operations. Most of the interviews were digitally recorded, and hand written notes were taken throughout all of the interviews. These investigative interviews were carried out using the following protocol:

- The interviewee was met at the designated time and place.
- Introductions were completed.
- The NIST investigation and the purpose of the interview were discussed with the interviewee.
- If a consent form was needed, it was explained to the interviewee, questions were answered, and the interviewee signed the consent form. (Only the Port Authority interviews used consent forms.)

- Just before the interview began and during the interview process, interviewees were ask if they needed to take a break before going further. This was particularly important during periods of the interview where emotional stress was evident.

- The interviewee began with an uninterrupted self- narrative that was followed by questions addressing specific areas of interest.

Self-Narrative, Emergency Responder's Experience at the WTC:

For response to World Trade Center Buildings 1 and 2:

- Each emergency responder was asked to describe their experience in their own words and end their narrative after WTC 1 and WTC 2 had collapsed.

For response to World Trade Center Building 7:

- Each emergency responder was asked to describe their experience in their own words and end their narrative after the WTC 7 collapse.

When the self-narrative was completed, the interviewee was asked if they would like to take a 10-minute break or proceed to the next step of the interview.

The next phase of the interview dealt with follow up questions.

Follow-up Questions: The follow-up questions were typically related to the interviewee's timeline of events and were used to probe specific points from the narrative. Questions were based on notes taken during the self-narrative. The follow-up questions consisted of questions related to the following topics and experiences of the interviewee during the WTC operations:

- dispatch, arrival, and job assignment during emergency operations;

- the resources available for initial situational assessment and incident management;

- practices for determining the possibility of structural collapse;

- command post establishment, information available, communications, and operations;

- firefighter accountability, location, and tracking;

- building occupant egress as related to fire service operations, rescue options for building occupants;

- fire and emergency response protocols for tall buildings;

- the ability to fight large fires on the upper floors of tall buildings (including the human physiological factors associated with operations in tall buildings);

- operations and function of information technologies, emergency responder information systems, alarm systems, building occupant information systems, communications systems, radios and repeaters, other communications systems;
- the influence of building design (e.g., height, stairways, elevators, smoke control systems) on fire service command and control procedures and rescue operations;
- firefighter operations and safety of emergency responders;
- elevator conditions and operations, elevator control panel information and function, and the use of elevators by emergency responders;
- environmental conditions inside and around WTC buildings 1, 2, and 7 before the buildings collapsed;
- the influence of aircraft impact damage and fuel run-off on fire service command and control procedures, life saving operations, and safety of emergency response personnel;
- standpipes and fire hoses, and other pre-positioned emergency equipment;
- the impact of systems failures (e.g., communications systems, water supply, sprinklers, standpipes) on fire service command and control procedures, life saving operations, and safety of emergency response personnel;
- pre-planning, training, and standard operating procedures (including command and control) at the time of the WTC attack;
- emergency responder evacuation from the WTC 1; and
- communications and coordination of response activities between various authorities at the WTC, i.e. fire wardens, fire safety directors, building security, FDNY, PAPD, NYPD, OEM, and PANYNJ building safety and operations personnel.

When the interview was complete, depending on the interview agreement, the interviewer gave the interviewee a copy of a psychological support resources information sheet containing contact information for Project Liberty and their employer's support services, and the interviewer would answer any remaining interviewee questions. (Project Liberty is a New York state program created in 2001 to provide supportive crisis counseling to individuals and groups affected by the World Trade Center disaster.)

The interviewer would thank the interviewee for participating and walk them to the door, ending the interview.

The interviewer would complete interview notes, secure the audio recording (if used), and prepare for completing work on written documentation of the interview.

2.2.4 Visual Data

- Still photographs, film, and digital images
- Motion images, video clips and movie film

The visual data were largely acquired by Dr. William Pitts of NIST and his staff. Numerous photographs and video records were acquired from FDNY and NYPD. Many of these images address the WTC towers prior to their collapse and images taken after the towers collapsed. Uncut documentary video of FDNY operations at the WTC was acquired from Jules and Gedeon Naudet. In addition, thousands of other photographs and video clips were obtained from PANYNJ and other New York City news media sources and the public. All of these visual data were critical for understanding the facts related to the attack and the emergency response that followed. For more information on visual data collection and analysis see NIST NCSTAR 1-5A.

Figure 2–1 provides a map of the WTC location in lower Manhattan.

Figure 2–1. Map showing the World Trade Center location in lower Manhattan.

Chapter 3
IMPACT OF THE FEBRUARY 1993 BOMBING ON EMERGENCY RESPONSE IN TALL BUILDINGS

The February 26, 1993, terrorist sub-grade bombing of the World Trade Center (WTC) provided insight into the complications of a full evacuation of the towers and the complex nature of responding to a large incident at the towers. Investigations by The Port Authority of New York and New Jersey (PANYNJ or Port Authority) and New York City emergency response departments identified numerous issues concerning the WTC buildings and complex. This chapter addresses these issues and the changes made at the WTC following the 1993 attack. The multi-agency study of the WTC bombing identified security issues, occupant safety issues, and emergency responder operations and safety issues. Issues addressed by the Port Authority were discussed in a document provided for this investigation.[1] In addition, the Director of the Port Authority's World Trade Department discussed the findings from the 1993 bombing in his testimony before the 9/11 Commission on May 18, 2004 (Reiss 2004). The following changes were made at the World Trade Center after the 1993 bombing and relate to emergency responder operations during the attack carried out in 2001.

3.1 CHANGES MADE BY PANYNJ

- Installation of tower sprinkler systems was accelerated. The work on the systems began before 1993.
- Improvements were made to the Concourse level to improve egress.
- A new Port Authority Police Command Center was established inside WTC 5.
- Fire Command Desks were installed in the lobbies of WTC 1 and WTC 2.
- A radio repeater was installed in WTC 5 that operated on The Fire Department of the City of New York (FDNY) city-wide high-rise frequency. The antenna was located on the top of WTC 5 and was directed at WTC 1 and WTC 2. Controls for operating the repeater were originally located at the Port Authority Police Desk inside WTC 5. During the spring of 2001, controls for repeater operation were moved to the Fire Command Desk inside the lobby of each of the towers.
- The elevator intercom system was upgraded allowing for monitoring at the Fire Command Desk.
- A new Operations Control Center with the capability to monitor all HVAC systems and elevators in both towers was constructed on the B1 level of WTC 2.

[1] Port Authority Communication: "WTC – CHANGES TO EVACUATION SYSTEMS AFTER 1993." WTC-115-P.

- Multiple power sources were installed for exit stairway lighting in the towers.
- A new decentralized Fire Alarm System Class E (Style 7), with three separate data risers to transponders that were located every three floors. This system had redundant control panels and multiple control station announcement capability.
- Fire drills were conducted in conjunction with the FDNY.

Although significant effort and funds were put into improving the WTC complex after the 1993 bombing, the damage caused by the aircraft impact left many of these improvements non-functional on September 11, 2001 (addressed in Chapter 5).

In addition to the changes made by the Port Authority, FDNY addressed numerous issues that affected their operations and safety at the 1993 WTC bombing. These issues are discussed in a report prepared by the FDNY Chief of Department (Fusco 1993). The section below briefly describes each issue followed by a discussion of how the lesson-learned impacted FDNY operations on September 11, 2001.

3.2 CHANGES MADE BY FDNY

3.2.1 Incident Command System

Issue

A better understanding of the incident command system (ICS) was needed by all New York City emergency responders to ensure full implementation and better adherence to the system. (Fusco 1993):

Delegation of Functions: The scope of the 1993 bombing was beyond anything ever experienced and information overload occurred at the incident command level. The FDNY Incident Command System policies and procedures were upgraded following the 1993 bombing. The May 1997, ICS Manual reflects changes made to the Incident Command System, and these new policies had been in operation with FDNY for approximately four years when the WTC attack occurred in 2001. Therefore, the Incident Command System improvements had been in use by the department for several years before the 2001 attack and were being followed by department personnel during operations on September 11, 2001.

The FDNY 1997 Incident Command System Manual revised delegations of responsibility for the incident command system in the following areas (Fusco 1993):

- command,
- planning,
- operations,
- logistics, and
- finance.

A copy of the FDNY 1997, Incident Command System manual is found in Appendix A.

Issue

Interagency Representation: All agencies must be sensitive to and coordinate operations for effective incident command. A representative from each agency should be at the command post to make coordination easier (Fusco 1993).

Changes to Interagency Coordination: In an attempt to reduce the uncertainty associated with the issue of coordination of operations, the New York City Mayor's Office established an operations protocol. (See Appendix B) In April of 1994, FDNY and The New York City Police Department (NYPD) published a document entitled "Police/Fire Protocol." See Appendix B.

3.2.2 Communications

Issue

FDNY needed to improve communications at a large incident (Fusco 1993).

Change to Communications: New York City purchased eighty 800-Megahertz radios for use by deputy fire commissioners, staff chiefs, and the Field Communications (Field Com) Unit. Twenty of the radios were to be distributed by the Field Com unit at the WTC during the September 11, 2001, attack. FDNY made an effort to significantly improve the radio communications system for high-rise firefighting. The high-rise repeater was requested by FDNY for operations in the WTC and the Port Authority installed it.[2] Even though it did not solve all of the radio communications problems at the WTC FDNY personnel interviewed indicated that it did improve operations prior to the September 11, 2001, attack.[3] Another item that improved FDNY radio communications at the WTC was that firefighting companies located near the WTC and that often responded to the WTC were issued Port Authority radios that allowed them to communicate with the building's Deputy Fire Safety Directors and with the Port Authority Police Department (PAPD).[4] FDNY bought new 400 MHz band radios to replace all the radios in the department used during the 1993 bombing. However, the new radios had been pulled from service because of operational difficulties prior to the WTC attack, and the older VHF radios used during 1993 were put back into service, leaving the service with equipment that had been judged to be less than ideal.[5]

Issue

Radios needed a **tone alert** capability for signaling emergency conditions (Fusco 1993). At the 1993 bombing, one firefighter became trapped and called a mayday. The incident commander was unable to communicate well during this emergency because the volume of handie-talkie traffic made it difficult or impossible to hear. It was recommended that a built-in alert tone be added to the radios so that the tone could be sent out to clear the air so that control could be regained over the radio system. (Fusco 1993)

[2] PA Interview 11, fall 2003.
[3] FDNY Interview 16, winter 2004.
[4] PA Interview 11, fall 2003.
[5] Written Communication from New York City, October 6, 2004.

No tone alert was available on the radios used by FDNY firefighters on September 11, 2001.[6]

Issue

Command Posts: Command posts needed to be more isolated from the intense activity that takes place at a very large incident, and the command post must be clearly identified. Computer terminals and communications capabilities are needed in vans for command post operations and the operations should be duplicated at the branch and sector command locations. Any data added to the computer systems at any location would be automatically updated at all other command locations. (Fusco 1993)

The capabilities addressed above in the issue were not available to FDNY personnel on September 11, 2001.[7]

Issue

Transmission of Alarms: FDNY needed to more clearly identify alarms greater than a fifth alarm (Fusco 1993).

The FDNY Communications Manual in effect on September 11, 2001, did not address procedures for operations greater than a fifth alarm.[8]

Issue

Field Communications Unit: The field communications unit was expected to receive and transmit critical information on the fire ground. The incident command system relies heavily on a Field Com unit at large incidents, and an officer should be assigned to manage the operations (Fusco 1993).

Changes for Field Com: FDNY placed an officer in charge of Field Com units and the department's Field Com unit was improved. However, the primary Field Com unit was not available during the period of time before the WTC towers collapsed.[9, 10]

3.2.3 Interagency Protocols

Issue

The 1993 post-bombing analysis indicated that frequent drills were needed to ensure that protocols would function as planned. All agencies working together needed to have a technical understanding of each other's role so that working cooperation would develop. It was recommended that FDNY and NYPD establish working relationships with each other, particularly with aviation rescue operations and that aviation rescue drills, including roof top operations, be conducted (Fusco 1993).

[6] FDNY Communications Manual, DCN: 3.01.01, January 1, 1997.
[7] FDNY Communications Manual, DCN: 3.01.01, January 1, 1997.
[8] FDNY Communications Manual, DCN: 3.01.01, January 1, 1997.
[9] FDNY Communications Manual, DCN: 3.01.01, January 1, 1997.
[10] FDNY, Interview 58, winter 2004.

Changes in Interagency Protocols: After the 1993 bombing of the WTC, New York City established the Office of Emergency Management (OEM), which took on the job of promoting the improvement of interagency operations; however, on September 11, 2001, the OEM center located at WTC 7 became ineffective as WTC 7 was evacuated.[11]

3.2.4 Building Systems and Fire Safety Personnel

Issue

FDNY maintained that state legislation should be enacted to apply New York City building codes to all structures in New York City, including the World Trade Center (Fusco 1993). FDNY needed this to be able to enforce the codes and maintain standardization and knowledge of a building's fire protection features (Fusco 1993).

Changes to Building Systems and Fire Safety Personnel: FDNY made progress on this issue during the period between 1993 and 2001 through agreements with the PANYNJ. In 1993, two agreements were entered into by the Port Authority and New York City regarding fire safety of Port Authority facilities located in New York City. These agreements are located in Appendix C.

- The first agreement allowed for the implementation of fire safety recommendations that would be made by FDNY after they had inspected PANYNJ facilities located in New York City.
- The second agreement gave FDNY permission to conduct fire safety inspections of PANYNJ properties in New York City and provided guidelines for FDNY to communicate needed corrective actions to the PANYNJ. It assured that new or modified fire safety systems would be in compliance with local codes and regulations. It also required a third party review of the systems by a New York State licensed architect or engineer.

3.2.5 Elevators

Issue

Elevator searches needed to be prioritized, with public assembly elevators having the highest priority, and elevator mechanics needed to work with fire department personnel while conducting rescue operations (Fusco 1993).

Changes to Elevator Policies: By 1997, FDNY had instituted these new elevator policies and procedures. The 1997 FDNY elevator policy is located in Appendix D of this report.

[11] FDNY Interview 54, winter 2004.

3.2.6 Protective Clothing

Issue

The weight and bulk of turnout coats and boots were determined to reduce the effective working time of firefighters when they had to climb stairs for hours. Other work jackets and shoes were recommended for climbing the stairs if fire was not an issue, and they recommended that protective clothing be available when it was needed (Fusco 1993).

Changes for Protective Clothing: The recommendations from the 1993 post-bombing analysis had little impact on what happened during the attack of 2001. Firefighters climbed many flights of stairs while wearing their protective clothing and carrying heavy firefighting equipment. Since there were large fires burning in the buildings, this protective clothing and equipment would have been used if they had been able to reach the fire floors and conducted firefighting operations.[12] Also, the Port Authority had installed small stocks of firefighting equipment at the Sky Lobbies on the 44th and 78th floors. A Port Authority Police officer wearing his duty uniform was able to climb to the 44th floor and open the equipment storage locker. However, these supplies would not have been adequate for conducting the large-scale firefighting operations that were needed. In addition, NYPD Emergency Service Unit personnel were operating in the buildings with air-packs but without thermal protective clothing.[13]

3.2.7 Contaminated Stairwells

Issue

The stairways in the World Trade Center towers were smoke filled throughout their entire 110 floors during the 1993 bombing. Smoke moved through the building mainly by elevator shafts and stairways. Then the smoke moved onto the floors and into other stairways as evacuees opened stairway doors (Fusco 1993).

Changes for Stairwells: Although the Port Authority had made some changes to the buildings' stairwells, on September 11, 2001, the stairs above the fires again became filled with smoke and hot gasses, trapping people on the upper floors of the buildings.[14] Primary improvements to the stairways were to new emergency lighting systems and painting photo-luminescent markings on the stairs and connecting stairway landings. Some of the changes did have a positive impact on the stairways located below the impact zones. Stairways are discussed in section 5.6.4.

[12] FDNY Interview 17, winter 2004.
[13] PA Interview 10, fall 2003.
[14] PA Interview 11, fall 2003.

3.2.8 News Media

Issue

A chief officer needed to be assigned to work with the media on large incidents (Fusco 1993).

The study of news media operations at a large incident was not a goal associated with the NIST investigation. However, during the course of the investigation, it became apparent that news media functions associated with a large disaster was a subject that required review. It is apparent from FDNY Chief Fusco's report of the 1993 bombing at the WTC that emergency responders and the news media needed a better means to coordinate their operations (Fusco 1993).

Changes Associated with News Media: The 1997 FDNY Communications Manual describes the department's policy for media liaison operations.[15] However, on September 11, 2001, operations between emergency responders and the news media were not totally effective. The difficulties impacted emergency responders, the news media, people trapped inside the WTC towers, and the public at-large. As the attack and emergency operations at the WTC unfolded, many of the emergency responders either learned of the attack from the news media or obtained some of their most useful information about the attack from media coverage. In contrast, it is apparent that New York City emergency response agencies had less than effective operations associated with gathering information and communicating it to appropriate parties. This included the communication of some critical emergency response and evacuation information to the news media so that it could be broadcast to the public. One example of this was the fact that stairway "A" in WTC 2 was passable for evacuation from floors above the building's aircraft impact zone (NIST NCSTAR 1-7). It is apparent that this information was neither gathered nor communicated to the news media so that evacuation directions could be broadcast to people trapped on the upper floors of the building.

News service personnel responded quickly to the WTC site to cover this tragic event. Mayor Giuliani and his staff of Commissioners attempted to provide information to the news media (Giuliani 2002). However, the number of reliable information sources available to the news media did not appear to be adequate for the influx of requests for information. Port Authority records indicate that the news media from around the world were attempting to access the emergency responder departments.[16] This is highlighted by the fact that during the first two hours of the attack and emergency operations at the WTC, the Port Authority telephone system at WTC 5 recorded 19 telephone calls from the news media. Many of these telephone calls were received by the Port Authority Police Department (PAPD) at their desk located at WTC 5 while they were attempting to carryout life saving operations. This interfered with the PAPD's ability to conduct emergency operations that were critical to life safety issues such as medical aid for the injured, the rescue of trapped building occupants, and the evacuation of people from the WTC site. It also interfered with PAPD facilities security operations.

News media telephone calls were captured on PANYNJ telephone communications recordings covering Channels 2, 8, 9, 10, 23, 24, and 26. Some of these news media telephone calls were from New York City area organizations. Others were from news departments and radio talk shows from across North

[15] FDNY Communications Manual, DCN: 3.01.01, Chapter 7, January 1, 1997.

[16] Port Authority telephone communications recordings Channels 2, 8, 9, 10, 23, 24, and 26.

America. At least one of the media calls was received from Europe. All the news media telephone calls were transferred to the appropriate PANYNJ public information office.

The following summarizes findings associated with emergency responder/news media operations:

- Emergency responder/news media communications were less than totally effective during the WTC operations on the morning of September 11, 2001.
- Critical information related to life safety and evacuation from the WTC towers was not communicated to the news media so that it could be broadcast to people trapped inside the WTC towers above the building fires.
- Some news media contacts with emergency responder agencies interfered with the emergency response and life saving operations. Appropriate emergency response agency contact points were bypassed or not used by some news media for gathering information.
- It appears that emergency response agencies were overwhelmed by news media requests for information.

3.2.9 Preplanning and Command Organization

Issue

The magnitude of the 1993 attack heightened FDNY's awareness of the need for preplanning and command organization that went beyond the scale of operations carried out during the 1993 bombing. Intra and interdepartmental drills were needed to ensure operations, and the specter of larger disasters was raised (Fusco 1993).

As shown above, FDNY made numerous changes to department operations and planning in an attempt to successfully function under conditions where a large number of people are affected over a large area. As will be seen in the rest of this report, some of their improvements had a positive effect on fire department operations until WTC 2 collapsed. With the collapse of the towers and the loss of large numbers of personnel, emergency operations radically changed.

3.3 REFERENCES

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Chapter 4
CHRONOLOGY OF EVENTS BASED ON COMMUNICATIONS DATA

The chronologies listed in this chapter were drawn from the detailed chronology located in Attachment 2. These chronologies provide the reader with a sense of timing related to the WTC attack and the unfolding emergency response operations. The following selected communications provide information concerning (1) dispatch and arrival of emergency response units, (2) evacuation, (3) emergency response operations, and (4) chronology of the WTC towers.

Note: These chronologies are based on the best possible data provided to NIST for the analysis. The times are given to represent the event sequence. Based on the variations of recorded clock times for the data and times assigned for each recording provided by the departments, it is estimated that the margin of error for each time is approximately ±2 minutes. (E) indicates that the time is an estimate from the original source or has been estimated by the authors based on the available data. All other times listed are based on time recordings or reported clock readings.

4.1 DISPATCH AND ARRIVAL OF EMERGENCY RESPONDERS CHRONOLOGY

The following chronology demonstrates that the emergency response to the World Trade Center (WTC) was immediate. Within the first three minutes after the aircraft impact into WTC 1, (1) the Port Authority Police Department (PAPD) responded by providing information on the attack to the police desk; (2) The Fire Department of the City of New York (FDNY) dispatched 26 units to the WTC; and (3) The New York City Police Department (NYPD) called a department mobilization that included dispatching aviation units to the WTC for visual assessment. In less than 10 minutes, PAPD called a chemical mobilization; NYPD dispatched five Emergency Service Unit (ESU) teams and had two aviations units at the scene providing observations. In less than 30 minutes, 121 FDNY units had been dispatched to the scene and 30 units had signaled their arrival at the scene.

8:46 a.m. FDNY Battalion Chief reports that an airplane has struck the upper floors of a WTC building and transmits a first and second alarm (FDNY, McKinsey & Company, 2002)

PAPD officer reports to the police desk an explosion at the WTC. (PAPD Radio Channel Y/Channel 2)

8:48 a.m. 26 FDNY units dispatched. (FDNY Dispatch log)

NYPD calls for a department mobilization. (NYPD Special Operations Division (SOD) Radio Channel)

8:49 a.m. NYPD requests that aviation units get into the air and make a visual assessment of the WTC (NYPD SOD Radio Channel)

8:50 a.m. PAPD officer calls for a chemical mobilization. (PAPD Radio Channel W)

8:52 a.m. A total of five NYPD Emergency Service Units dispatched. (NYPD, McKinsey & Company, 2002)

NYPD aviation requests landing zone in the vicinity of the WTC. (NYPD SOD Radio Channel)

NYPD aviation unit arrives at the WTC and examines possibilities of roof rescue. (NYPD, McKinsey & Company, 2002)

8:54 a.m. NYPD aviation advises they have two units in the air to do aerial survey. (NYPD SOD Radio Channel)

8:59 a.m. FDNY Chief calls for all but one Rescue Squad to the WTC. (FDNY Manhattan Dispatch Radio Channel)

9:00 a.m. A total of 66 FDNY units have been dispatched at this time. (FDNY Dispatch log)

9:03 a.m. FDNY Marine unit reports that a second plane struck WTC 2. (FDNY Manhattan Dispatch Radio Channel and FDNY, World Trade Center Incident Summary, 2001)

9:15 a.m. A total of 121 FDNY units dispatched, and 30 FDNY units signal* their arrival. (FDNY Dispatch log)

9:29 a.m. FDNY dispatcher relays that a department-wide recall has been instituted. (FDNY, World Trade Center Incident Summary, 2001)

9:59 a.m. A total of 171 FDNY units dispatched, and 74 FDNY units signal their arrival. (FDNY Dispatch log)

10:29 a.m. A total of 214 FDNY units dispatched, and 103 FDNY units signal their arrival. (FDNY Dispatch log)

*Note: FDNY arrival times are determined from 10–84 signals transmitted by units as they arrive at their assigned location. A 10-84 signal is sent by a firefighter from a fire department vehicle by pressing a button on the communications console. Figure 4–1 below gives a visual representation of the FDNY units dispatched versus a specific time.

4.2 EVACUATION CHRONOLOGY

The evacuation chronology exhibits a mix of responses to the disaster. It provides insight into the successes and shortcomings of the evacuation from the WTC buildings and site. The first noteworthy event is that multiple orders were given by a senior PAPD police officer to evacuate the WTC buildings and the entire complex. There is no evidence that these orders were transmitted to appropriate personnel at the site to initiate the full evacuation of the complex. Some of these communications also show that the

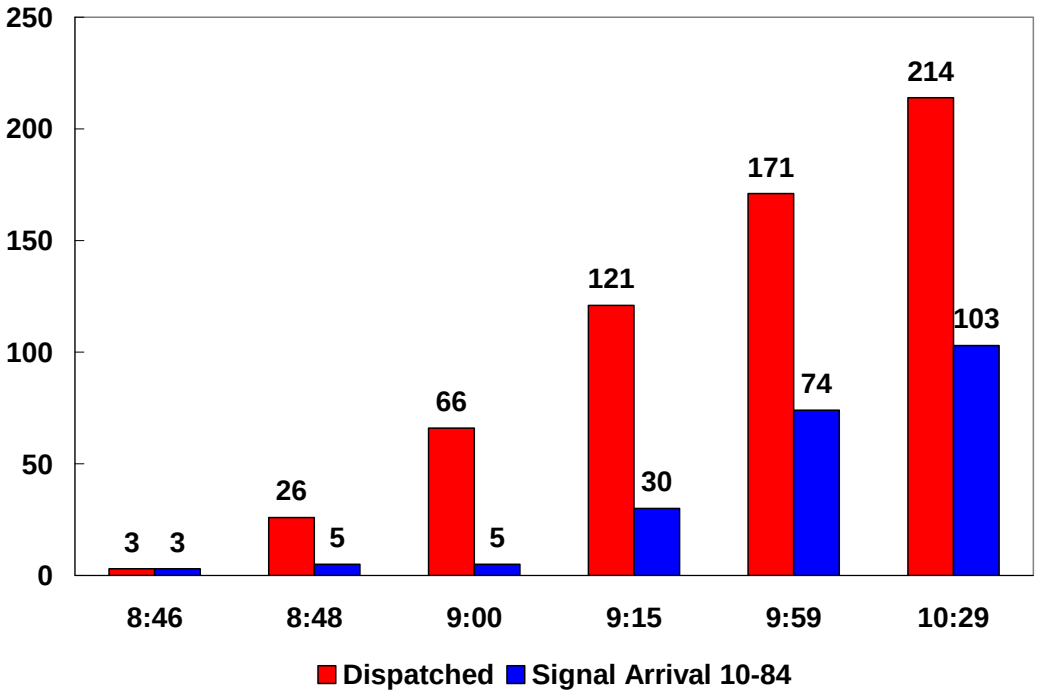

Figure 4–1. Number of FDNY units dispatched and signaling arrival at specific times.

evacuation process was not always orderly and controlled. It was reported that people were running from the PATH trains, and a report came in to the PAPD police desk from a police officer in WTC 5 stating that "I have people going crazy." Since people could not evacuate from floors above the impact zone and large fires were burning below them, the first-person jumped from WTC 1 at 8:52 a.m., only 6 minutes after the first aircraft struck WTC 1. However, a significant portion of the evacuation process from the WTC complex was orderly. This chronology also indicates that PANYNJ, PAPD, and building security personnel held their posts in the face of life threatening conditions to assist people in the evacuation. In addition, these communications provide some basic information about the status of people trapped in the buildings and the fact that the elevators in the buildings were not functioning or dangerous to use. Finally, several cases are listed where injured, elderly, or physically impaired people were not able to walk down the stairs in the building and needed assistance to evacuate.

8:47 a.m. WTC Vertical Transportation receives a message to evacuate the building (WTC 1) and send people out toward WTC 5. (PA/WTC Vertical Transportation, Radio Channel Z)

WTC Vertical Transportation receives a message from a PAPD officer instructing employees to avoid the Concourse. (PA/WTC Vertical Transportation, Radio Channel Z)

8:48 a.m. WTC Vertical Transportation receives two orders calling for the evacuation of the building, WTC 1. (PA/WTC Vertical Transportation, Radio Channel Z)

8:52 a.m. PAPD police desk receives report from police officer that people are jumping out of the windows from WTC 1. (PAPD Radio Channel W)

8:53 a.m. WTC Security report indicates that people are running from the PATH trains. (WTC Security Radio Channel X)

8:54 a.m. A dispatcher relays information to the FDNY Command Posts that people are trapped on floor 106 of WTC 1. (FDNY, 9-11-2001 Time Line Document and FDNY 9/11 Summary notes)

8:56 a.m. PATH trains are still bringing people into the WTC site. (PAPD Radio Channel W)

WTC Operations attempts to assemble personnel at WTC 1 exits to the plaza to show people how to get out. One Port Authority employee responds to the message saying that he cannot get over to the building exits because glass is falling all over the place. (PA/WTC Operations Radio Channel Y)

WTC Security receives a radio message that they need assistance in WTC 4 because people are attempting to exit the building. (PA/WTC Security Radio Channel X)

8:57 a.m. WTC Security: a message is sent stating, "Don't let anyone in the building evacuate to the Plaza at this time." (PA/WTC Security Radio Channel X)

8:58 a.m. WTC Security instruction to security guards: hold your post and don't allow people into the Plaza or out onto the Courtyard. (PA/WTC Security Radio Channel X)

PAPD police desk reports that people are trapped on floor 79 of WTC 1. (PAPD Radio Channel W)

8:59 a.m. PAPD police desk: a senior PAPD officer calls for the evacuation of WTC 1 and WTC 2. (PAPD Radio Channel W)

PAPD police desk: a senior PAPD officer calls for the evacuation of the entire WTC complex, all buildings. (PAPD Radio Channel W)

9:00 a.m. PAPD police desk: a police officer asks if building five should be evacuated, and he was told to stand by. (PAPD Radio Channel W)

WTC Security receives a report that there are people trapped inside suite 8711 of WTC 1 and they can't get out. (PA/WTC Security Radio Channel X)

PAPD police desk: orders were given to evacuate WTC 1, B4 level. (PAPD Radio Channel W)

WTC Operations: a Port Authority employee calls in that he is on floor 27 in the C staircase and has a man in a wheel chair and needs assistance. (PA/WTC Operations Radio Channel Y)

9:01 a.m. PAPD police desk: a senior PAPD officer calls for the evacuation of all buildings in the WTC complex. (PAPD Radio Channel W)

9:02 a.m. WTC Operations: Port Authority employee calls in reporting that he is stuck in an elevator on floor 78 of WTC 1 in car number 81A. (PA/WTC Operations Radio Channel Y)

9:03 a.m. A second aircraft strikes WTC 2. (FEMA 403)

9:04 a.m. WTC Operations: A call is made to evacuate everybody from the building now. Note: Building not identified. (PA/WTC Operations Radio Channel Y)

9:05 a.m. WTC Security: a security officer indicates that WTC 4 is being evacuated. He is then going to WTC 5. He also reports "I have people going crazy." (PA/WTC Security Radio Channel X)

WTC Operations: A report comes in that Port Authority employees heard people stuck inside of some elevators and also report that they are getting them out. (Note: Building and location not identified.) (PA/WTC Operations Radio Channel Y)

WTC Operations: A call comes in to get everybody off the complex. (PA/WTC Operations Radio Channel Y)

9:07 a.m. WTC Operations: A report comes in that somebody is stuck in an elevator on floor 76. (Note: Building not identified.) (PA/WTC Operations Radio Channel Y)

9:08 a.m. WTC Security: report from an officer that debris is falling from WTC 2 by WTC 4 and Liberty Street, and to let the people out of WTC 4. (PA/WTC Security Radio Channel X)

9:09 a.m. WTC Security report is received indicating that FDNY is entering elevator bank 11, 12. (Note: Building not identified. Elevators 11 and 12 are shuttle elevators. Elevator 11 goes from the lobby to the 44th floor. Elevator 12 goes from the lobby to the 78th floor.) (PA/WTC Security Radio Channel X)

9:10 a.m. WTC Security receives a report that the express elevators could be in jeopardy of falling. (Note: Building not identified.) (PA/WTC Security Radio Channel X)

9:12 a.m. WTC Security receives a radio report from the Command Desk in the lobby of WTC 2 saying that they cannot communicate with the Warden phones and that they are making announcements telling people not to stay at the Warden phones. (Note: This communication indicates that the Warden phones in WTC 2 were not working. Warden phones are located on each floor of the building for the use of floor wardens. They are wired for communications with the fire command desk in the building lobby.) (PA/WTC Security Radio Channel X)

9:14 a.m. PAPD police desk receives confirmation that no elevators are working. (Note building not identified.) (PAPD Radio Channel W)

9:16 a.m. FDNY radio dispatcher advises a chief that there are people trapped in WTC 1 at the following locations: floor 82 east side; floor 83, room 8311; floor 103, room 103 near the

corner, floor 104; and floor 106, and in WTC 2 at the following locations: floor 82 west side; floor 88; and floor 89. (FDNY 9/11 Summary notes)

9:17 a.m. PAPD police desk reports that four callers have made contact and need assistance on floor 106 of WTC 1. (PAPD Radio Channel W)

9:20 a.m. PAPD police desk receives a message from an officer that no one is down on the B4 level of WTC 1. (PAPD Radio Channel W)

9:23 a.m. FDNY radio dispatcher advises FDNY Field Communications Unit that 100 people are overcome in WTC 1 on the northwest and southwest corners of floor 103. The dispatcher also reports that Ladder 3 reports numerous injuries in the stairwell at floors 35 and up. (FDNY 9/11 Summary notes)

9:24 a.m. PAPD police desk receives a report from an officer that people from floor 64 are now coming down onto the courtyard level of WTC 1. (PAPD Radio Channel W)

9:28 a.m. PAPD police desk receives a radio report of a person with burn injuries caused by a falling elevator. (Note: Location of injured person was provided as A20. This may mean WTC 1 on floor 20 on the A stairway.) (PAPD Radio Channel W)

9:29 a.m. WTC Security reports that there is a medical emergency in the B stairway; there is a person that cannot walk down. The people are coming down from floor 51, and the person needing assistance has asthma. (Note: Building not identified.) (PA/WTC Security Radio Channel X)

9:30 a.m. WTC Security receives a report that two elderly people on floor 51, B stairway, WTC 1, cannot walk down and need medical assistance. (PA/WTC Security Radio Channel X)

9:37 a.m. PAPD police desk recorded the following message: "All World Trade Center units to the Command Post. All World Trade Center units escort everybody over the land bridge on West Street to the Financial Center. Do not, repeat, do not send people out into the Concourse on to south side." (PAPD Radio Channel W)

9:45 a.m. WTC Security receives a report that officers are sending people down, evacuating on the A stairway in WTC 1. (PA/WTC Security Radio Channel X)

WTC Security gets a request for crowd control on Broadway. Answer to the request is that the City police should be responding. (PA/WTC Security Radio Channel X)

9:56 a.m. WTC Security receives a report that WTC 1 is not completely evacuated and that people are still coming out of each stairway. (PA/WTC Security Radio Channel X)

4.3 EMERGENCY RESPONSE OPERATIONS CHRONOLOGY

This section provides an overview of the emergency response operations carried out by FDNY, NYPD, and PAPD at the WTC. The chronology highlights several communications that identify cases where

emergency responders were assisting injured people, calling for EMS assistance, and searching for functioning elevators to help evacuate injured people. Some fires in the buildings are identified, and some firefighting operations in WTC 2 are identified. Communications from PAPD provide information on the locations of many people who were trapped in the buildings and in elevators. Several communications provide insight into FDNY operations in WTC 2 and show that some firefighters actually reached the 78th floor in WTC 2. This ascent to the 78th floor was assisted by the use of an elevator that operated until just before the building collapsed. The elevator became stuck in the elevator shaft, and the firefighter operating the elevator was chopping his way out when the building collapsed. Several radio communications provide insight into the difficulty that emergency responders had trying to climb the stairs of the WTC towers. Cases are noted where FDNY personnel had to stop and rest. Radio communications from the FDNY channel 7 repeater also point out the difficulty that some firefighters had with the identification of the two buildings. The exchange of communications by FDNY personnel at 9:29 a.m. clearly shows this difficulty. Several communications from NYPD aviation units show how the aircrews repeatedly explored the possibility of landing on the roof of WTC 1 and reported that conditions were not safe for landing. However, at 9:38 and 9:40 a.m., an aviation unit calls in for permission to land on the roof of WTC 1. No evidence has been found that indicates that WTC occupants were seen on the tower roof or that conditions had improved when these radio requests were made. Interviews with aviation personnel indicate that many of them were highly troubled by the number of occupants trapped in the buildings and the number of people jumping from the buildings, and they were distressed that they were unable to help them.[1, 2, 3] At 9:43 a.m., a senior police department official ordered that no one from the aviation units was to "rappel" on the building's roofs. Rappel in this case means to descend down a rope attached to a helicopter onto the roofs of the WTC buildings. Communications in this section also reflect the fact that many people were coming to the WTC to volunteer their assistance. Many volunteers were turned away as the emergency responders felt that they needed to get everybody away from the WTC complex.

8:46 a.m. An aircraft strikes WTC 1. (FEMA 403)

8:49 a.m. WTC Security: A message is received that Emergency Medical Service (EMS) is needed because there is an injured security guard. The message was not complete; the location was not understandable. (PA/WTC Security Radio Channel X)

8:50 a.m. FDNY establishes a command post in the lobby of WTC 1. (FDNY McKinsey & Company, 2002)

WTC Security message from an officer on the B2 level of WTC 1 saying that there are two workers injured on that level and that EMS is needed "ASAP." (PA/WTC Security Radio Channel X)

PAPD police desk receives a radio call from FDNY Ladder 10 requesting information from PAPD about which building was struck and the location of the fire, WTC 1 or

[1] NYPD, Interview 14, winter 2004.
[2] NYPD, Interview 20, winter 2004.
[3] NYPD, Interview 21, winter 2004.

WTC 2. FDNY uses a Port Authority Radio for the communication. (PAPD Radio Channel W)

8:52 a.m. NYPD aviation unit arrives at the WTC to examine possibilities for roof rescue. (NYPD McKinsey & Company 2002)

8:56 a.m. WTC Security: an officer calls for an ambulance at WTC 4 for an injured person. (PA/WTC Security Radio Channel X)

8:58 a.m. NYPD aviation unit advises that they are unable to land on the roof due to heavy smoke conditions. (NYPD SOD Radio Channel)

9:00 a.m. WTC Security receives a message saying that there is an injured person between floors 14 and 15 of WTC 2. (PA/WTC Security Radio Channel X)

9:01 – 9:03 (E) FDNY Incident Command Post is established on West Street opposite WTC 1 (FDNY, McKinsey & Company, 2002)

9:01 a.m. WTC Security receives a report of a fire in a parking lot. (PA/WTC Security Radio Channel X)

9:02 a.m. WTC Security receives a report of a gas leak. (Note: Incomplete message, location of leak not identified.) (PA/WTC Security Radio Channel X)

9:03 a.m. An aircraft strikes WTC 2. (FEMA 403)
PAPD – by this time a PAPD senior officer has called three times for the evacuation of the World Trade Center, WTC 1 and WTC 2, and then "all buildings in the complex." (PAPD Radio Channel W)

WTC Security reports that another aircraft has stuck WTC 2. (PA/WTC Security Radio Channel X)

9:05 a.m. PAPD police desk, an officer calls in and requests that every ambulance that can be spared be sent to the WTC. (PAPD Radio Channel W)

9:08 – 9:13 (E) FDNY establishes a Lobby Command Post inside WTC 2 at the Fire Command Desk.[4]

9:10 a.m. FDNY dispatcher receives a message saying that people are trapped on floor 86 of WTC 2. (FDNY 9-11-2001 Time Line Document)

9:11 a.m. FDNY Field Com unit begins operations to maintain status. (FDNY, McKinsey & Company, 2002)

9:11 a.m. FDNY reports that Engine 10 requests that all responding units stop short of the WTC buildings, either north or south of Liberty and West Street because of the large

[4] FDNY Interview 7, winter 2004.

number of parked ambulances and debris falling from the buildings. (FDNY 9/11 Summary notes)

9:16 a.m. (E) FDNY Command Post and Staging area designated for WTC 2 at West and Albany Streets. (FDNY, McKinsey & Company, 2002)

9:17 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) indicates that they are using an elevator for operations in WTC 2. (PA/WTC Radio Channel 30 recording)

9:18 a.m. FDNY radio communication from WTC 2 indicates they have one elevator working to floor 40, and it is staffed by a firefighter from Ladder 15. (PA/WTC Radio Channel 30 recording)

PAPD police desk receives a report that FDNY is abandoning its command post and going across the street. (PA/WTC Security Radio Channel X)

9:22 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) states that a Battalion Chief is on floor 43 or WTC 2 in the B stairway. (PA/WTC Radio Channel 30 recording)

FDNY Battalion Chief now located on floor 43 of WTC 2 receives a message from a FDNY member that NYPD Emergency Service police officers (Emergency Service Unit) are in the building and want to provide support for him. The Battalion Chief gives the Emergency Service Unit police officers direction to his location on floor 43 in the B stairway. (PA/WTC Radio Channel 30 recording)

9:26 a.m. NYPD aviation unit advises that it is impossible to land on the roof at this time. (NYPD SOD Radio Channel)

9:29 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30): a Battalion Chief is communicating that he is located inside "Tower 2, the South Tower." A firefighter follows the communication attempting to correct the Chief by saying that he was actually in the "North Tower, Tower 2." (Note: This communication confused the actual location of the Battalion Chief, who later came back on the radio reporting that he was in the South Tower. Interviews with FDNY personnel[5] conclusively show that the Battalion Chief was actually inside WTC 2, the South Tower.) (PA/WTC Radio Channel 30 recording)

9:30 a.m. PAPD police desk receives a report that EMS is setting up a triage station in the lobby of WTC 2. (PAPD Radio Channel W)

[5] FDNY interview 2, winter 2003 and FDNY interview 7,winter 2004.

9:32 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) Firefighters communicated that they have been able to get to floor 55 inside WTC 2. (PA/WTC Radio Channel 30 recording)

9:38 a.m. NYPD aviation unit calls in to request a landing on the roof of the North Tower as soon as possible. (NYPD SOD Radio Channel)

9:39 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30): FDNY officer inside WTC 2 indicates that he is sending 10 to 15 injured people down to floor 40 and that the firefighter at that location should take the injured to the building's lobby in the elevator. The officer also requests that the firefighter operating the elevator bring an EMS crew back up with him. (PA/WTC Radio Channel 30 recording)

9:40 a.m. NYPD officer advises that they need the aviation units on the roof as soon as possible. (NYPD SOD Radio Channel)

9:41 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30): Hazmat 1 (Hazardous Materials Unit) reports that they are on floor 48 of WTC 2 in the B stairway. (PA/WTC Radio Channel 30 recording)

9:42 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A firefighter informs the Battalion Chief that he cannot find any elevator banks that are operating above floor 40. The Chief advises the firefighter that he should climb the B stairway from his location. (PA/WTC Radio Channel 30 recording)

WTC Security receives a report that people have arrived and want to volunteer to help and asks where they should be sent. Answer: "Right now just send everybody away from the World Trade. We are not letting anybody come close to it." (PA/WTC Security Radio Channel X)

PAPD police desk receives a radio report that a triage center has been set up at WTC 4 at Victoria's Secret. (PAPD Radio channel W)

9:43 a.m. NYPD officer advises that no one is to rappel onto the tops of the buildings. (NYPD SOD Radio Channel)

9:44 a.m. WTC Security receives a communication saying that "They haven't evacuated the Fire Command over here in building 2 or 1." (PA/WTC Security Radio Channel X)

9:44 a.m. (E) The Office of Emergency Management operations center inside WTC 7 is evacuated. (FDNY, interview 24, winter 2004)

9:45 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A firefighter calls the Battalion Chief and reports that they had to take their coats off. (PA/WTC Radio Channel 30 recording)

9:49 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A Battalion Chief instructs a firefighter that it is imperative that he get down to the lobby command post to get some people up to floor 40. Injured people are being sent down from floor 70. The firefighter is inside an operating elevator and is reporting that it is not operating properly and expresses concerns about the elevator becoming stuck in the shaft. (PA/WTC Radio Channel 30 recording)

9:50 a.m. WTC Security receives a message saying that FDNY needs a resuscitator on floor 19, B corridor of WTC 1. (PA/WTC Security Radio Channel X)

9:54 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A Battalion Chief calls for a Ladder company in the A stairway to extinguish two fires. They are attempting to stretch building hose lines on about floor 78. (PA/WTC Radio Channel 30 recording)

FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A firefighter calls to the Battalion Chief that he is on floor 55 and must stop to rest. (PA/WTC Radio Channel 30 recording)

WTC Vertical Transportation message indicates that an officer is located on floor 22, fire command center and that there is heavy traffic in the B stairway. The person indicates that they cannot release any emergency locked doors due to fire and the loss of electrical power. (Note: Communication appears to originate from WTC 1.) (PA/WTC Vertical Transportation Radio Channel Z)

WTC Security receives a report that there are 18 passengers stuck in an elevator on the floor 78 sky lobby of WTC 2 and that firefighters are working to get them out. They request EMS at the location on the double. (PA/WTC Security Channel X)

9:56 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30): inside WTC 2, a firefighter states they are in the B stairway and that they will have to put some fire out in order to get to the A stairway. (PA/WTC Radio Channel 30 recording)

9:57 a.m. WTC Security receives reports by radio on the Security Radio Channel X and by phone from floor 78 of WTC 2 that people are coming out of the elevator banks. (PA/WTC Security Radio Channel X)

At and below floor 79 of WTC 2, FDNY, NYPD, and PAPD personnel are evacuating occupants, assisting the injured and fighting fires.

FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30) A firefighter in WTC 2 reports that he is trapped in an elevator in the elevator shaft and that they are chopping their way out. (PA/WTC Radio Channel 30 recording)

9:59 a.m. FDNY Marine unit reports the collapse of WTC 2. (FDNY World Trade Center Incident Summary, 2001)

10:28 a.m. FDNY Marine unit advises that the second WTC tower collapsed. (FDNY World Trade Center Incident Summary, 2001)

4.4 CHRONOLOGY OF THE WTC TOWERS

Information provided by this chronology partially describes the variable conditions found in WTC 1 and WTC 2. The impact of the first aircraft into WTC 1 and the fires and overpressure that resulted created significant damage down to the building's basement. The impact of the aircraft into WTC 2 produced jet fuel fires in the building on the 51st floor. Other communications indicate that there was no smoke or fire on the 68th, 73rd, or 74th floors and that the walls in stairway B had been breached. A telephone call to a New York City 9-1-1 telephone operator at 9:37 a.m. indicates that a floor in the 90s level of WTC 2 had collapsed. According to NYPD records, information from this call concerning the floor collapse in the 90s appears to have been conveyed inaccurately by the 9-1-1 call taker and the NYPD radio dispatcher.[6] The NYPD dispatcher transmitted the message at 9:41 a.m. and again at 9:51 a.m., identifying the collapsed floor as being the 106th floor. Communications from the NYPD aviations units describes a steady deterioration of the two WTC towers before they collapsed.

8:47 a.m. WTC Security reports that there is a fire on floor 22 of WTC 1 (PA/WTC Security Radio Channel X)

8:49 a.m. WTC Security reports that there is damage and a lot of debris on floor 22 of WTC 1 (PA/WTC Security Radio Channel X)

8:51 a.m. PAPD police desk receives a call that an explosion was observed in the basement of the B1 level of WTC 1. The police desk informs the officer on the B1 level that what he saw resulted from an explosion on the upper floors of the building. (PAPD Radio Channel W)

8:57 a.m. PAPD police desk receives report that water pipes are broken on the B4 level of WTC 1. (PAPD Radio Channel W)

9:02 a.m. WTC Operations receives a message from a person trapped in an elevator on floor 78 of WTC 1 that the area has smoke, and water and debris are coming down from above. (PA/WTC Operations Radio Channel Y)

9:10 a.m. PAPD police desk receives a report that there is burning jet fuel on floor 51 of one of the towers. (Note: Communications suggest this is WTC 2.) (PAPD Radio Channel W)

9:13 a.m. WTC Security receives a report that WTC 1 is flooding. (PA/WTC Security Radio Channel X)

[6] McKinsey & Company, NYPD call-routing and message dispatch, "106th floor is collapsing," draft summary report July 23, 2002.

9:32 a.m. WTC Security receives a message from an officer that the WTC Concourse is flooding. (PA/WTC Security Radio Channel X)

9:37 a.m. New York City 9-1-1 telephone operator receives a message from an occupant of WTC 2 that a floor had collapsed below them in the 90's level. (Note: The person calling the 9-1-1 operator indicated they had gone to floor 105.) (NYPD, McKinsey & Company, call-routing and message dispatch summary report, 2002)

9:41 a.m. NYPD dispatcher advises units that floor 106 in WTC 2 is collapsing and that the message comes from someone on that floor. (NYPD Division 1 Radio Channel)

9:47 a.m. FDNY radio communications on the City-wide, high-rise Channel 7 (PA/WTC Radio Channel 30): a firefighter inside WTC 2 reports that he is standing in the B stairway on floor 74 and there is no smoke or fire problem. He reports that the stairway walls have been breached on floors 73 and 74. Another FDNY unit in the same stairway reports that the walls were also breached on floor 68. (PA/WTC Radio Channel 30 recording)

9:51 a.m. NYPD dispatcher advises that at WTC 2, floor 106 is crumbling per communications with victims trapped on the floor. (NYPD SOD Radio Channel)

9:52 a.m. NYPD aviation unit gives a radio report stating that "large pieces" may be falling from the top of WTC 2. Large pieces are hanging up there. (NYPD SOD Radio Channel, NYPD interviews #21 and #23)

9:58 a.m. NYPD aviation unit advises that the south tower is coming down. (NYPD SOD Radio Channel)

10:06 a.m. NYPD officer advises that it isn't going to take much longer before the north tower comes down and to pull emergency vehicles back from the building. (NYPD SOD Radio Channel)

10:20 a.m. NYPD aviation unit reports that the top of the tower might be leaning. (NYPD SOD Radio Channel)

10:21 a.m. NYPD aviation unit reports that the north tower is buckling on the southwest corner and leaning to the south. (NYPD SOD Radio Channel)

NYPD officer advises that all personnel close to the building pull back three blocks in every direction. (NYPD SOD Radio Channel)

10:27 a.m. NYPD aviation unit reports that the roof is going to come down very shortly. (NYPD SOD Radio Channel)

10:28 a.m. NYPD officer reports that the tower is collapsing. (NYPD SOD Radio Channel)

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Chapter 5
ANALYSIS OF EMERGENCY RESPONDER OPERATIONS

5.1 METHODOLOGY

For this project, data were collected as described in Chapter 2. NIST personnel began analyzing the first data as soon as it was collected and continued throughout the investigation as new information was gathered. NIST personnel working on this part of the investigation carried out "lead following" activities to locate information critical for analysis, and as the "lead following" activities progressed analysis processes became a natural part of the work. The process of "lead following" was also used to assist in identifying emergency responders who needed to be interviewed. Information analysis and "lead following" made up a substantial part of the first-person interview process. However, the final analytical work was not completed until report writing was in progress.

One of the first steps in the analysis was to create a chronology of factual data associated with the emergency operations. The chronology was developed from a large number of sources that are identified in Attachment 2 of this report. The second step in the analysis was to convert all of the written documents and interview notes into a searchable computer database. ATLAS.ti, a commercial quantitative analytical software program, was used for structuring the database and conducting searches for any given emergency response subject of interest (Muir 1997). This software allowed personnel to assemble related data from numerous different digitally based data sources so that they could be brought together for final analysis. The analysis process consisted of one person analyzing information gathered followed by multi-person discussions among project staff and agreement on the findings.

ATLAS.ti Program Usage

For this part of the investigation, the ATLAS.ti program was limited to textual data only. All first-person interviews conducted by NIST were transcribed along with radio and telephone communications of interest. The transcripts and other pertinent documents were converted to a text file format and imported into the ATLAS.ti program. A total of 812 documents were entered into the ATLAS.ti program. First-person interviews accounted for 116 of these, radio and telephone transcriptions accounted for 46, and other documents obtained by the investigation accounted for the remaining 650. These other documents were from the various emergency response organizations mentioned earlier (The Fire Department of the City of New York (FDNY), The Port Authority of New York and New Jersey (PANYNJ), and The New York City Police Department (NYPD)) and contained a broad variety of information dealing with standard operating procedures, training, equipment, and practices used during operations at the WTC.

Information and topics selected for analysis were processed using ATLAS.ti by introducing codes into the text or marking specific portions of text and assigning them into categories of interest. The NIST investigation identified 125 categories associated with the emergency response analysis at the WTC, and the 812 documents were coded or marked so that ATLAS.ti could recover information for each of the categories. For example, one category of interest was accountability or tracking of personnel. Within the 116 first-person interviews conducted, the idea or concept of accountability of personnel was coded

93 times. Some individuals interviewed never mentioned accountability while others spoke about it multiple times. The information on accountability gathered from these interviews was further broken down by organization (FDNY, NYPD, or PANYNJ) and at what level in the organization the person was working. The interviewee could be identified as a firefighter, police officer, team leader, or command officer, etc. Whether the individual was speaking of something that happened on September 11, 2001 regarding accountability or something that they wished for in the future that would make accountability at any incident an easier task was also coded. By polling the database using ATLAS.ti, information from each source and category could be gathered for analysis. Review and analysis of each item located by ATLAS.ti in the database and analysis of the complete data set assembled provided detailed, as well as generalized, information about the category searched.

The following sections discuss results of the analysis, including supporting evidence of the emergency response carried out on September 11, 2001, at the World Trade Center.

5.2 ANALYSIS OF THE INFLUENCE OF BUILDING DESIGN ON EMERGENCY RESPONSE

Building design can have a significant impact on the ability of emergency responders to access involved areas, access areas where occupants may be trapped, evacuate building occupants, and conduct safe emergency response operations. Building access is critical to emergency responders, both for ground level entry and for all parts of a building where emergency response operations are needed. High-rise building designs present their own unique challenges for the emergency responder. Some of these challenges are: (O'Hagan 1977)

- entry and overall building access;
- elevators, elevator communications, elevator information panels, and control systems;
- egress, stairways, and the limits to firefighting strategy related to stairway locations;
- building information systems, fire alarm panels;
- emergency and fire alarm communications systems;
- active fire suppression systems, building water supply, fire pumps, and standpipe systems;
- smoke management systems;
- height of the building and limits related to exterior fire attack strategies;
- large area open floor plans with minimal compartmentation; and
- emergency responder communications, command and control.

Building height becomes an immediate challenge when safe and operational elevator systems are not available. As building height increases, emergency responder access becomes limited. The emergency

responder must rely on other building systems and other aspects of the building design to assist with managing an emergency.

Building design has an influence on emergency responder Command and Control as well. Building construction materials and separations can adversely affect the ability of emergency responders to communicate. Additionally, in recent years, lightweight building construction using truss joist systems has led many fire departments to institute additional safety policies related to the possibility of structural collapse (Dunn 1988). These policies relate to both metal truss and wood truss systems. This has affected fire department operations when addressing life saving and firefighting operations. The issues raised by truss construction are highlighted in the building construction section of the fire service training manual entitled, Essentials of Fire Fighting (Hall 2000). Building design is an integral part of emergency response and firefighting operations. As discussed below, building design can seriously affect emergency responder operations.

Prior to September 11, 2001, the largest fire in the World Trade Center towers above the lobby level occurred on February 13, 1975. This fire broke out on the 11th floor of WTC 1. The fire grew and involved approximately one quarter of the 11th floor. The fire also spread into the telephone equipment closets and extended from the 9th floor through the 16th floor (O'Hagan 1977). This experience provided FDNY with the first opportunity to fight a sizable fire in the towers and provided lessons for operations in the towers for the future. In his analysis of the fire, former FDNY Fire Commissioner John O'Hagan pointed out the following issues related to fighting fire in the World Trade Center towers:

> ' Floor size and the size of the fire in the 1975 incident: "If the alarm had been delayed an additional 30 to 60 minutes, it is reasonable to expect that the entire east half of the building could have been involved." "If the east half of the building had been involved, it is unlikely that a direct attack would have been successful. In that case we may have had to choose a defensive strategy." (O'Hagan 1977)

O'Hagan's statement refers only to the east half of the 11th floor in WTC 1 and raises the issue of the large size of the floors in the World Trade Center towers. One half of one floor involved in fire would have been approximately 1,350 m^2 (15,000 ft^2). According to standard calculation methods used by the fire service, it would take water flow rates of approximately 4,700 l/min (1,250 gal/min) to extinguish half of a WTC floor. This would require approximately five 63.5 mm (2.5 in) handlines with 28.5 mm (1.125 in) diameter smooth tip nozzles (NFPA 1997). With a fire this size on the 11th floor of the building, O'Hagan suggests that a defensive strategy may have been the only way to fight the fire until additional resources were available and master streams could be used against the fire. O'Hagan suggests a defensive strategy for attempting to stop fire spread across the remaining floor. This would be done by establishing handline fire hose operations at the floor's central corridor and attempting to hold the fire's progress long enough to get large master stream nozzles onto the floor.

O'Hagan also raises the issue of time. He refers to a delay of 30 to 60 minutes that would allow the fire to grow. Since the 1975 fire was on the 11th floor, the time delay in getting personnel and equipment up to the fire floor was relatively short. However, on September 11, 2001, the lowest part of the aircraft impact zone for WTC 1 was the 93rd floor, and the lowest part of the aircraft impact zone for WTC 2 was the 77th floor. Without the use of elevators it would take firefighters approximately two hours or more to

- A fire was started on the B4 level of WTC 1 when the first plane struck. The interviewee said that he believes that burning jet fuel ignited the fires.[14]

Since the first fire department personnel who entered WTC 1 following the aircraft impact actually saw the aircraft hit the building, these firefighters had a general idea of building damage before they got to the scene. They knew that the building safety systems were likely damaged and that the building had absorbed the energy of a large aircraft impact.[15, 16] Upon entering WTC 1, FDNY personnel met with Port Authority personnel and the former WTC 1 Deputy Fire Safety Director to learn more about building conditions.[17] Also upon entering the building, FDNY saw victims burned by the fireball that came into the building's lobby. Some of these seriously burned people were still alive; fire department personnel tried to give them aid even though they were not likely to survive. Some of the bodies were still burning and firefighters used handheld fire extinguishers to put them out. [18]

FDNY personnel identified the following related to building conditions and emergency response operations in the building:[19, 20]

- the initial fire department size-up of the event was that a large aircraft had hit WTC 1, and there were large fires burning on multiple floors at and above the impact zone,
- it was reported to the FDNY Battalion Chief who established the WTC 1 Lobby Command Post that the elevators were not working and/or were not generally safe for use during the WTC operations; however one elevator was used briefly by FDNY,
- people were trapped inside many of the elevators,
- firefighters would have to gain access to the injured and trapped occupants by climbing the stairs and carrying the equipment needed up the stairs,
- it was likely that the water supply on the upper floors was damaged and that firefighting would not be an option until a reliable water supply was established and equipment was carried up. It appeared that the sprinkler and standpipe systems were compromised at the impact zone,
- FDNY command personnel learned from 9-1-1 dispatch operators that smoke, fire, and structural damage in the buildings prevented many building occupants from evacuating floors above the impact zones,

[14] Other Interview 1, fall 2003.
[15] FDNY Interview 2, fall 2003.
[16] FDNY Interview 20, winter 2004.
[17] FDNY Interview 24, winter 2004.
[18] FDNY Interview 13, winter 2004.
[19] FDNY Interview 2, fall 2003.
[20] FDNY interview 7, winter 2004.

- FDNY command personnel knew that jet fuel had flowed into the elevator shafts and into other parts of the buildings and presented a danger to building occupants and emergency responder personnel,
- the known extent of the impact damage, fires in the buildings, and the height of the impact zones indicated that many of the people trapped above the impact zones were already dead or would likely die before emergency responders could reach them,
- the impact zones were located at heights in the buildings that would require hours for the emergency responders to accumulate appropriate equipment and personnel to carry out the large scale operations needed to successfully access the upper floors, and
- structural damage and fires caused by the aircraft impact would likely result in localized collapses in and above the impact and fire zones.

As described above, aircraft impact damage and the fires started by burning jet fuel had a major impact on fire department operations. Access to the impact zone and fire floors was limited to climbing the stairs. Also, FDNY Chiefs knew that it would take hours to get enough people and equipment up to the impact zone to provide aid for the people trapped above the fires.

5.3.2 Systems Failures

The WTC towers contained building systems that were designed to help protect the occupants and the buildings, and also assist with emergency responder operations. Some of these key systems were as follows:

- fire detection and alarm systems,
- active fire suppression systems including the water supply,
- fire pumps and standpipe systems to supply water for firefighters to use in extinguishing fires,
- emergency communications systems for making announcements, elevator intercom systems, and communications systems for use by emergency responders,
- access and egress systems including elevators and stairways,
- emergency power and lighting systems, and
- smoke control and ventilation systems.

Each of the two aircraft struck the WTC towers at high speed, resulting in serious damage to their structural elements, and all of the life safety systems mentioned above were either damaged or

destroyed.[21, 22, 23, 24] The structural damage, as well as the loss of the building's safety systems, had a direct negative effect on the evacuation of building occupants and emergency responder operations.

5.3.3 Initial Emergency Response

Building tenants, including Port Authority personnel, became the first "emergency responders inside" the WTC towers on the upper floors, and they had very little equipment to assist them. One building occupant from the 73rd floor of WTC 1 stated the following during their first-person interview:

> - First responders on the high floors were the building tenants, and there were no adequate tools to use for rescue or fire suppression.[25] (NIST 2004)

Initial "size-up" of the conditions at WTC 1 was carried out by the first FDNY Battalion Chief who arrived on the scene. The following information is drawn from interviews with WTC 1 FDNY Command Post personnel and PANYNJ Fire Command Desk personnel and documents from the two agencies. The first Battalion Chief on the scene had observed the aircraft impact into the WTC 1 tower and immediately responded to the building.[26] Upon arrival at WTC 1, the FDNY Battalion Chief met with Port Authority personnel as he entered the building and requested information available concerning the attack, building conditions, and status of the elevators. A PANYNJ Vertical Transportation office employee had begun calling each of the building elevators over the dedicated elevator telephone system that was located at the lobby Fire Command Desk.[27] The building's former Deputy Fire Safety Director who operated the Fire Command Desk was checking building alarms and trying to make evacuation announcements.[28] It was found that the emergency communications system used to make the emergency announcements was inoperable as a result of the aircraft impact.[29] It was also learned by FDNY personnel upstairs inside WTC 1 that the warden phone system was damaged and the standpipe phone system was not operating.[30, 31, 32] However, the former WTC 1 Deputy Fire Safety Director indicated that he did receive calls at the Fire Command Desk over the warden phone system.[33] This information was communicated to the FDNY Chiefs. A building Fire Safety Director spoke with one of the FDNY Chiefs about the possibility of using elevator phones for communication with the building's Operations Command Center

[21] FDNY Interview 2, fall 2003.
[22] PA Interview 3, fall 2003.
[23] FDNY Interview 27, winter 2004.
[24] FDNY Interview 58, winter 2004.
[25] Interview 1000118 (NIST 2004).
[26] FDNY Interview 7, winter 2004.
[27] PA Interview 5, fall 2003.
[28] Other Interview 3, spring 2004.
[29] Other Interview 3, spring 2004.
[30] FDNY Interview 20, winter 2004.
[31] FDNY Interview 23, winter 2004.
[32] FDNY Interview 29, winter 2004.
[33] Other Interview 3, spring 2004.

(OCC). This person and a FDNY Battalion Chief were dispatched to go and check it out. These men were never seen again.[34]

The FDNY chiefs who were establishing the WTC 1 Command Post received information from the data sources described above and through their personal investigation of systems in the building.

Emergency responders reported the failures of critical communications systems inside WTC 1:

- One firefighter called up on the warden phone. There was one on every floor in the building and you can call the Lobby Command Post with it. He called but he couldn't get through. We went to the Verizon Company on the 23rd floor, and he called the Manhattan dispatcher on the phone and told them to pass a message to the Lobby Command Post.[35]

- The building intercom system was not working after the plane hit. Normally, announcements over the intercom would tell what stairways to use when going down.[36]

The facts that the impact zone and the large fires were so high in the building and that the building's water supply was compromised led the fire chiefs who established the original Command Post inside the lobby of WTC 1 to conclude that fire department efforts should be directed toward evacuation and rescue of building occupants.[37] Also, there were no working elevators that could transport firefighters and equipment up to a staging location just below the impact zone. The building conditions presented to them indicated that at best it would take hours to establish meaningful firefighting operations on the upper floors of the building.[38] The chiefs knew that this assessment did not give much hope for the survival of the people trapped above the fires in the building since the fires would continue to grow and the toxic fire gases would increasingly occupy the building spaces where the people were trapped.

Several of the early arriving FDNY firefighter companies, however, were originally ordered by Command Post personnel to go up the stairways to a couple of floors below the impact zone and establish a staging area and operations post for rescue and firefighting operations.[39] Some of these firefighter companies carried high-rise hose line packs up with them so that they would have the equipment for fighting fires if a water supply was available. After these initial firefighter companies were sent up, newly arriving companies were instructed only to carry out occupant evacuation and search and rescue operations.[40]

Failures of critical building systems (water supply, sprinkler systems, emergency egress routes, smoke control systems, and firefighting systems) and large fires that trapped large numbers of people on the upper floors of the exceptionally tall buildings created a difficult evacuation and rescue problem for the emergency responders. The fire chiefs at the original Command Post inside the lobby of WTC 1 knew

[34] FDNY Interview 20, winter 2004.
[35] FDNY Interview 29, winter 2004.
[36] FDNY Interview 43, winter 2004.
[37] FDNY Interview 20, winter 2004.
[38] FDNY Interview 45, winter 2004.
[39] FDNY Interview 7, winter 2004.
[40] FDNY Interview 2, fall 2003.

that they could not reach the building occupants trapped above the fires in time to successfully rescue them.[41] This critical factor was made clear by the dozens of people jumping from the upper floors of the building, and it directly influenced FDNY's planning and operations.[42]

5.4 ROOF RESCUE AND AVIATION OPERATIONS

Although the PANYNJ had not endorsed a plan for roof rescue from the towers, it appeared to be one of the few options available for occupants trapped above the fires. Recognizing the limited options for building evacuation at the WTC, the NYPD Special Operations Division (SOD) dispatched helicopters to the site for reconnaissance and to assess the possibility of roof rescue.[43, 44]

Roof Access and the WTC Emergency Preparedness Plan

The PANYNJ's 2001 WTC Emergency Preparedness Manual and evacuation procedures did not include a plan to provide roof rescue for occupants trapped in a building at the WTC site. Instead, the standard occupant evacuation procedures and drills required the use of stairwells to exit at the bottom of the WTC towers (NIST NCSTAR 1-7). The PANYNJ reports that it never advised tenants to evacuate upward (NIST NCSTAR 1-7). The WTC building evacuation training did not explicitly instruct occupants not to evacuate upward or attempt to access the roof. This also is confirmed by statements made by the Port Authority World Trade Director during his testimony to the 9/11 Commission on May 18, 2004 (Reiss 2004). The standard policy was to keep the doors to the roof locked with a key being required to gain roof access. No fire safety procedures explicitly called for opening these doors, including anyone on a "key run." On September 11, the WTC 1 Security Control Center (SCC) attempted to release all locks controlled by the computerized access system but was unable to do so because of aircraft damage to the system. During the 1993 bombing, NYPD conducted successful roof rescue operations from the top of the WTC towers. These operations were responsible for removing a small number of people during rescue operations.[45]

Roof Access and the New York City Building Code

The 1968 Building Code of New York City (BCNYC) paragraph C26-604.8(k) required access to roofs with slopes less than 20 degrees from at least one stair in buildings greater than three stories (12.1 m or 40 ft) in height. The Code does not state the purpose for this access, but since it is in the section on stair construction and not Means of Egress, it does not necessarily imply roof rescue but more likely providing fire department access to flat roofs. The current Code (2003) permits such access from a stair, ladder or scuttle, even more clearly not intended as an egress way for rescue. There is no prohibition of locking this access, which is consistent with fire department use since they have the means to open locked doors.

[41] FDNY Interview 2, fall 2003 and FDNY Interview 7, winter 2004.
[42] FDNY Interview 34, winter 2004.
[43] NYPD, SOD radio channel communications.
[44] NYPD Interview 20, spring 2004.
[45] NYPD Interview 19, spring 2004.

Aviation Based Roof Rescue

Aviation-based roof rescue procedures have a history that goes back to the 1970's. O'Hagan writes about two high-rise building fires that took place in Brazil, the Andraus building fire (February 24, 1972) and the Joelma Building fire (February 1, 1974). (O'Hagan 1977) The first fire occurred in a 31-story building, so many occupants who were cut off by the fire went up to the roof. As the fire burned out in the building, helicopter rescues were conducted. Even under favorable wind, weather, and fire conditions, it took helicopters approximately four hours to remove approximately 350 victims from the building's roof. The 1974 fire occurred in a 25-story building, and again, occupants went to the roof to be rescued. On this day, however, the wind and fire conditions had a negative impact on the safe operation of helicopters above the building. There was no wind, and the thermal plumes and smoke went directly up. It was dangerous for helicopters to attempt to fly in these conditions. Changing thermal conditions cause serious problems with lift in aircraft, and the reduced oxygen levels in the smoke clouds can cause aircraft engines to fail. As a result, approximately 90 of the 150 people who went to the roof perished since helicopter operations were not possible.

After the 1993 bombing, FDNY and NYPD developed a plan for roof rescue in the event that it was needed. Both departments realized the dangerous nature of conducting roof rescues. The following is extracted from the FDNY September 9, 1993 All Units Circular 269 entitled, *Air Support Plan – High Rise Fires* (Air Support Plan).[46] The complete document is contained in Appendix E.

> "In recent years, several high-rise fires have occurred throughout the world at which occupants became isolated from fire forces when they fled to the roof. Due to the media attention given to these events and the spectacular nature of helicopter evacuation, it can be anticipated that at future high-rise fires, people will ignore department advice and flee to the roof. Roof evacuation by helicopter is both hazardous and time consuming. Therefore, it shall only be undertaken as a last resort, and only upon the direction of the Fire Department Incident Commander (IC). However, large numbers of people on the roof cannot be ignored and the possibility exists that a helicopter approach may be the only access available."

The Air Support Plan addresses roof evacuation issues raised by investigations of high-rise building fires in other cities:

> "FDNY observers who visited the scene of these fires concluded that evacuation was unnecessary since the people on the roof were never in any immediate danger. On the other hand, many of the fatalities at these fires were people who suffered smoke inhalation in the halls and stairways while attempting to reach the roof. Had fire personnel been airlifted, ventilation and search of the stairwells and halls could have been effected."

[46] FDNY September 9, 1993 All Units Circular 269 entitled, *Air Support Plan – High Rise Fires.*

Objectives of the Air-Support Plan were:

- Provide FDNY with the capability to place fire personnel on the roof of high-rise buildings, otherwise inaccessible due to fire conditions for the purpose of ventilating and search.
- Control, comfort, and direct people who view themselves as trapped and remote from help.
- Provide the lobby command post with intelligence on roof conditions.
- Evacuate persons in need of immediate medical attention.
- Provide a capability to evacuate the roof as a last resort.

The following information pertinent to this investigation was extracted from section 105-6 of the NYPD manual entitled, *Aviation Manual – "High Rise Emergencies"*.[47]

High-Rise Emergencies:

- A high-rise emergency is an urgent situation in a building, which is over nine stories high, and in which persons are trapped or victims of crime and the rooftop is inaccessible from the ground level by emergency equipment or rescue personnel. The emergency may be the result of fire, explosion, terrorist act or other criminal activity.

  Upon confirmation of a high-rise emergency:

- Operations Supervisor: If the emergency is a high-rise fire, have FDNY personnel respond to the staging area and the highest ranking Fire Officer and aide will board the primary Bell 412 after Emergency Services Unit has secured the rooftop landing zone.

  Note: If persons are to be immediately removed from the high-rise roof via the hoist or by means of a rooftop landing, it is not necessary for any FDNY personnel to be onboard the aircraft, unless the FDNY personnel will be administering emergency care to those rescued.

- In the event of a non-crime fire, notify the flight crews that no landings on the roof will be attempted without FDNY approval.

During the first hour of the WTC operations, FDNY did not consider the option of roof rescue. The department was busy and focused on getting as many people out of the building as possible through the normal egress routes and providing aid for the injured.[48, 49, 50] In addition, when the second aircraft struck WTC 2 it was clear that this was a terrorist attack, and it resulted from criminal activity.[51] Therefore, the decision whether to conduct roof top operations became the responsibility of NYPD. Two NYPD

[47] New York City Police Department, Aviation Manuel – "High Rise Emergencies," 1993.
[48] FDNY Interview 2, fall 2003.
[49] FDNY Interview 7, winter 2004.
[50] FDNY Interview 9, winter 2004.
[51] FDNY Interview 19, winter 2004.

helicopters crews looked at the towers in an attempt to 1) determine if there was initially anyone on the roof of WTC 1 that required rescue, and 2) assess the overall roof conditions for possible emergency responder access to the building from the air.[52, 53] One of the two NYPD helicopters was almost hit by the second hijacked aircraft as it flew into WTC 2. Fortunately, one of the crew members on the helicopter saw the hijacked aircraft coming in from the south and yelled to the pilot to pull up.[54] The pilot immediately pulled up and looked through the viewing bubble at his feet and saw the airline pass just under the helicopter and crash into WTC 2.[55] Despite this near collision, the helicopters continued their observations, and one flew in toward WTC 1 to determine flight conditions near the northwest corner of the building.[56] Only the northwest corner of the building presented any chance for aviation operations since smoke from WTC 1 and WTC 2 covered the remaining top of WTC 1 and completely covered the top of WTC 2. [57, 58] See Figure 5–1 and Figure 5–2.

As the helicopter approached the northwest corner of the WTC 1 roof, aircrew members observed that window washing machinery and equipment was in the way. [59] Then, one of the aircrew monitoring instruments on the aircraft noted that the engine temperature suddenly began to rise. The pilot was informed, and the helicopter retreated from the approach, reporting that roof operations were not possible at that time[60, 61]. The following documents the radio transmissions from the aviation units to the SOD dispatcher concerning roof conditions and observations related to the possibility of roof operations:

8:52 a.m. NYPD aviation unit arrives at the WTC to examine possibilities of roof rescue. (NYPD, SOD Radio Channel) (NYPD, McKinsey & Company, 2002)

8:58 a.m. An aviation unit advises that they are unable to land on the roof due to heavy smoke conditions. (NYPD, SOD Radio Channel)

9:26 a.m. An aviation unit advises that it is impossible to land on the roof at this time. (NYPD, SOD Radio Channel)

[52] NYPD Interview 7, winter 2004.
[53] NYPD Interview 10, winter 2004.
[54] NYPD Interview 20, spring 2004.
[55] NYPD Interview 20, spring 2004.
[56] NYPD Interview 20, spring 2004.
[57] NYPD Interview 10, winter 2004.
[58] NYPD Interview 20, spring 2004.
[59] NYPD Interview 14, winter 2004.
[60] NYPD Interview 10, winter 2004.
[61] NYPD Interview 12, winter 2004.

Figure 5–1. Video image showing a NYPD helicopter flying near the World Trade Center buildings before WTC 2 was struck by the second aircraft

Figure 5–2. Photographs of smoke covering the roofs of the World Trade Center buildings

While this was happening in the air, senior NYPD SOD officers at the mobilization point were discussing the possibility of putting an Emergency Service Unit team on the roof of WTC 1. A roof rappel team was assembled and dispatched to the ball field located just off of West Street and adjacent to the schools located at the site.[62] A helicopter was dispatched to the site to pick them up. Over this same time period, NYPD aviation crews were observing increasing numbers of people jumping or falling from the towers and called for permission to land on the roof.[63] They stated that landing conditions had not changed on the roofs, but they wanted to help those people who were about to fall. At 9:35 a.m. the NYPD First Deputy Commissioner ordered that no roof rescues were to be attempted.[64] The NYPD aviation unit made the following radio transmissions:

9:38 a.m. A NYPD aviation unit calls in to request a landing on the roof of the North Tower as soon as possible. (NYPD, SOD Radio Channel)

9:40 a.m. A NYPD officer advises that they need the aviation units on the roof as soon as possible. (NYPD, SOD Radio Channel)

Shortly after these actions were taken, a senior NYPD SOD officer (after collecting information on the possibility of conducting roof operations) ordered that there would be no rappels onto the roofs of the towers.

9:43 a.m. NYPD officer advises that no one is to rappel onto the top of the buildings. (NYPD, SOD Radio Channel) Note: The term rappel refers to the process of using a rope suspended from a helicopter to descent on to the roof of a building.

The "no rappel" decision ended organized efforts to conduct aviation/roof operations on top of the World Trade Center towers.

5.5 EMERGENCY RESPONDER ACCOUNTABILITY AND TRACKING

The control of human resources is an important task and safety issue at all emergencies. It becomes significantly more important as emergency operations get larger and the numbers of units and people increase. Because of this, emergency responder organizations have instituted practices designed to help manage human resources. The policies and practices associated with the control of human resources at the scene of an emergency are referred to as *accountability* by the emergency responder community. Accountability includes the assignment, dispatch, checking in, tracking, locating, and checking out of emergency responders who operate at an emergency (Hall 2000). With the WTC attack, this also related to the recall of emergency responders. Recall refers to bringing emergency responders who are off duty or on leave back to duty status.[65] FDNY and the other responding agencies had recall policies in place and did recall personnel for WTC operations.[66, 67] Some emergency responders self-dispatched to the

[62] NYPD Interview 24, spring 2004.
[63] NYPD Interview 20, spring 2004.
[64] NYPD, McKinsey & Company report, 2002.
[65] FDNY Recall Procedures, see Appendix H
[66] FDNY Interview 3, winter 2004
[67] FDNY Interview 17, winter 2004

World Trade Center, and as the recalls were put into effect, it was reported that some emergency responders went to the WTC instead of reporting to their location of assignment.[68, 69] This created accountability problems for FDNY at the WTC.[70]

5.5.1 FDNY Accountability, Location, and Tracking

Firefighter accountability may be defined as the means of identifying and maintaining a time based record of where individual firefighters are located and working at an incident and what each firefighter is doing at the scene. Firefighter accountability is a critical part of the Incident Command System that assists with human resource management and the safety of individuals (Hall 2000). Basically, if there is a loss of firefighter accountability, the firefighter becomes lost at the incident. Unfortunately, failures of accountability on the fire ground have often been associated with the injury or death of firefighters (Hall 2000).

The FDNY Incident Command System Manual[71] published in 1997 says the following about the Incident Command System and accountability:

- The Incident Command System will improve firefighter safety by providing better accountability of personnel and improved use of resources and tactical effectiveness.
- STAGING – A specific area to which resources are assigned before deployment. Staging has several advantages:
    1. It gives the Incident Commander (IC) breathing room to make better decisions about deployment.
    2. It is a checkpoint to provide accountability and prevent freelancing.
    3. It provides an area of protection from exposure in hazardous environments.
    4. It establishes a reserve immediately available for a contingency.

The FDNY Incident Command System Manual, Part 1, 1997 is located in Appendix A.

The understanding of firefighter accountability is a basic part of initial firefighter training. It is a concept and a practice learned during the first phases of training and it receives continued training throughout a firefighter's career because of its importance to personal safety and successful emergency responder operations (Hall 2000). The 4th edition of *Essentials of Fire Fighting* (2000) says the following about personnel accountability systems (Hall 2000).

> "Each department must develop its own system of accountability that identifies and tracks all personnel working at an incident. The system should be standardized so that it is used at every incident. All personnel must be familiar with the system and participate when operating at an emergency incident. The system must also account for those individuals

[68] FDNY Interview 58, winter 2004.
[69] FDNY interview 63, winter 2004.
[70] FDNY Interview 68, spring 2004.
[71] FDNY Incident Command System Manual, ICS Manual, Part 1, May 1997.

> who respond to the scene in vehicles other than fire department apparatus.
>
> Accountability is vital in the event of a serious accident or structural collapse. If the IC does not know who is on the fireground and where they are located, it is impossible to determine who and how many may be trapped inside or injured. …Too many firefighters have died because they were not discovered missing until it was too late."

In career fire departments, firefighter accountability typically begins at the fire house. Firefighters working on a company shift are managed by an officer who ensures that the company roster has a full complement of firefighters for that shift. Firefighters are checked in, and a riding list is prepared for each company. The riding list identifies personnel and job assignments for each firefighter.[72, 73] On September 11, 2001, the attack occurred just before shift change.[74, 75] In some firehouses, this resulted in two crews of firefighters being available at the firehouse to fill one company's riding list.[76] Since the previous shift's crew was technically off duty, they would normally not be a part of a crew responding to an operation after the shift change had occurred. However, FDNY has a policy that allows a company officer to assign extra volunteer members to the crew, and they would be added to the company's riding list.[77] When the alarms for the WTC started coming into the firehouses, numerous firefighters from the previous shift were available to work. Interviews with FDNY company officers and firefighters indicated that there were many cases where firefighters that had just gone off duty were officially added to the company roster for work at the WTC.[78] FDNY company officers typically limited the number of volunteer members to the maximum number of riding positions located on a fire apparatus.[79]

FDNY Safety Bulletin 67, *Approved Riding Positions on Apparatus*[80], dated December, 1982 describes approved riding positions:

- Bearing in mind that an enclosed, seated, belted position is the safest location while riding an apparatus, officers shall assign these positions first. The officer then assigns positions in a descending order of priority. Ex.: 1. Enclosed, seated, belted position; 2. Seated, belted position; 3. Standing – side positions/ with restraining devices; 4. without restraining devices.
- The rear step of the apparatus is never to be used as a riding position. Its sole function is to load and unload hose.

Safety Bulletin 67, Approved Riding Positions on Apparatus, 1982 is reproduced in Appendix F.

There was one report that off-duty firefighters rode the rear step of a fire apparatus to get to the WTC.[81] It is not known if the company officer was aware that these individuals were riding on the apparatus. The

[72] FDNY Interview 1, fall 2003.
[73] FDNY Interview 31, winter 2004.
[74] FDNY Interview 20, winter 2004.
[75] FDNY Interview 37, winter 2004.
[76] FDNY Interview 20, winter 2004.
[77] FDNY Regulations, Chapter 11, *Fire and Emergency Operations*, DCN 3.01.00, January 1997.
[78] FDNY Interview 20, winter 2004.
[79] FDNY Safety Bulletin 67, *Approved Riding Positions on Apparatus*, December 1982 (See Appendix F).
[80] FDNY Safety Bulletin 67, *Approved Riding Positions on Apparatus*, December 1982.
[81] FDNY Interview 12, winter 2004.

practice of firefighters riding the rear step of an apparatus is unsafe and was discarded by FDNY in 1982 as a result of firefighter injuries and deaths that were occurring across the country.[82]

After arrival at the scene of an emergency, firefighter accountability becomes a matter of the units reporting to a Command Post or Staging Area, maintaining unit cohesion and discipline, and keeping the Command Posts informed of unit locations and operations (Hall 2000).[83] The first Command Post established at the WTC was set up at the Fire Command Desk inside the lobby of WTC 1.[84] This was the primary Incident Command Post that was moved outside and managed by the Chief of Department.[85, 86] Figure 5–3 shows locations for the FDNY Incident Command Post setup on West Street just outside of World Financial Center 2, the NYPD Mobilizations Points set up around the WTC site, the general locations of other Command Posts, and the Engine 10 / Ladder 10 firehouse location. Figures 5–4 and 5–5 show locations of the buildings' fire alarm panels, Fire Command Desks, and FDNY Lobby Command Post locations inside WTC 1 and 2.[87, 88, 89, 90, 91, 92, 93] Also, it should be noted that the elevator operations data system and elevator communications phone was located at each of the buildings' Fire Command Desks.

When FDNY sets up a Command Post, it also sets up a Portable Command Post for the operation. The Portable Command Post is described in Appendix G. The Portable Command Post is also referred to by the firefighters as the Command Board. The Portable Command Post consists of an aluminum case measuring approximately 457 mm x 711 mm x 203 mm (18 in. x 28 in. x 8 in.). See the photograph of the Command Board that was set up inside WTC 1 in Figure 5–6. The Command Board case contains the following (Appendix G):

- A vertical magnetic surface for recording box identification, time out, incident location and height, construction, dimensions if building is involved.
- A supply of magnetic identifiers that provide color code identification for units: Engine, black; Ladder and Tower Ladder, red; Battalions, gold; special units, blue; and sectors, purple. Unit numbers were typically written on the identifiers by marking pens.
- A 25 Watt, 6 channel radio with DC power supply and AC power pack and a magnetic base antenna with wiring and terminal blocks.
- A folding aluminum stand with legs and nylon straps to support the Portable Command Post.

[82] FDNY Safety Bulletin 67, *Approved Riding Positions on Apparatus*, December 1982.
[83] FDNY Interview 56, winter 2004.
[84] FDNY Interview 7, winter 2004.
[85] FDNY Interview 2, fall 2003.
[86] FDNY Interview 7, winter 2004.
[87] PA Interview 11, fall 2003.
[88] FDNY Interview 2, fall 2003.
[89] FDNY Interview 5, winter 2004.
[90] FDNY Interview 20, winter 2004.
[91] FDNY Interview 62, spring 2004.
[92] FDNY Interview 65, spring 2004.
[93] NYPD Interview 24, spring 2004.

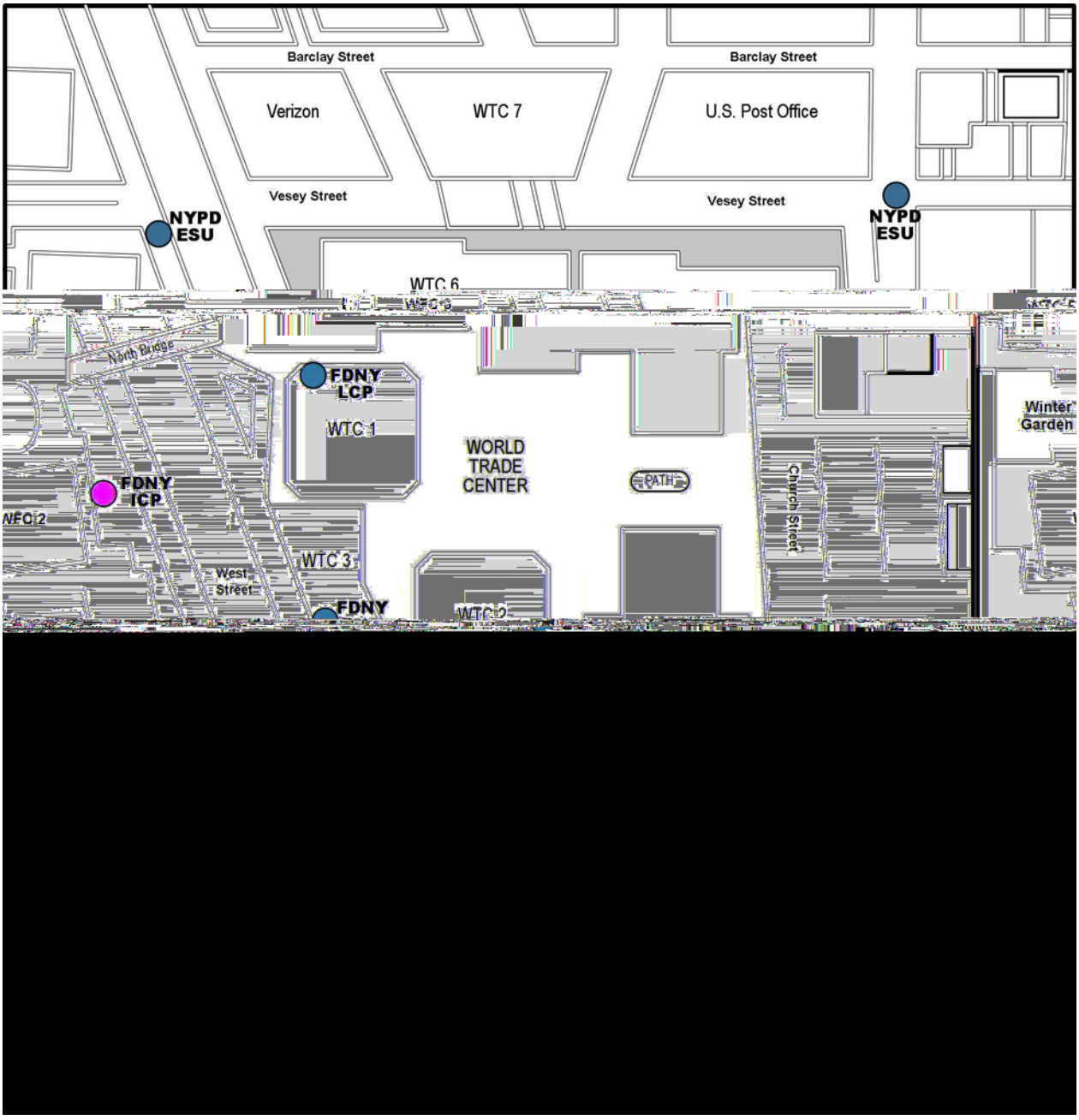

Figure 5–3. Diagram showing emergency responder command post locations.

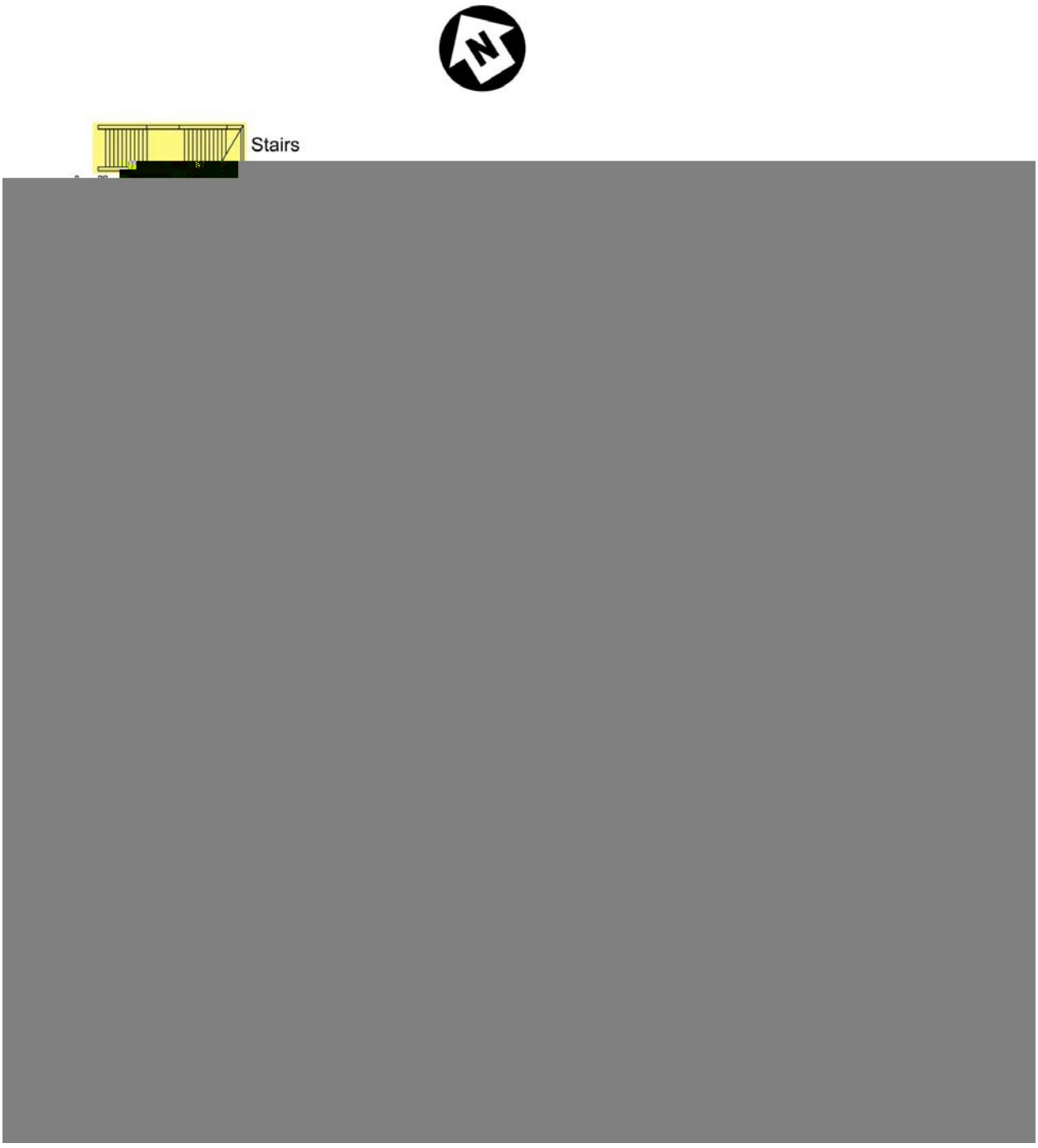

Figure 5–4. Diagram of lobby command post location inside World Trade Center 1.

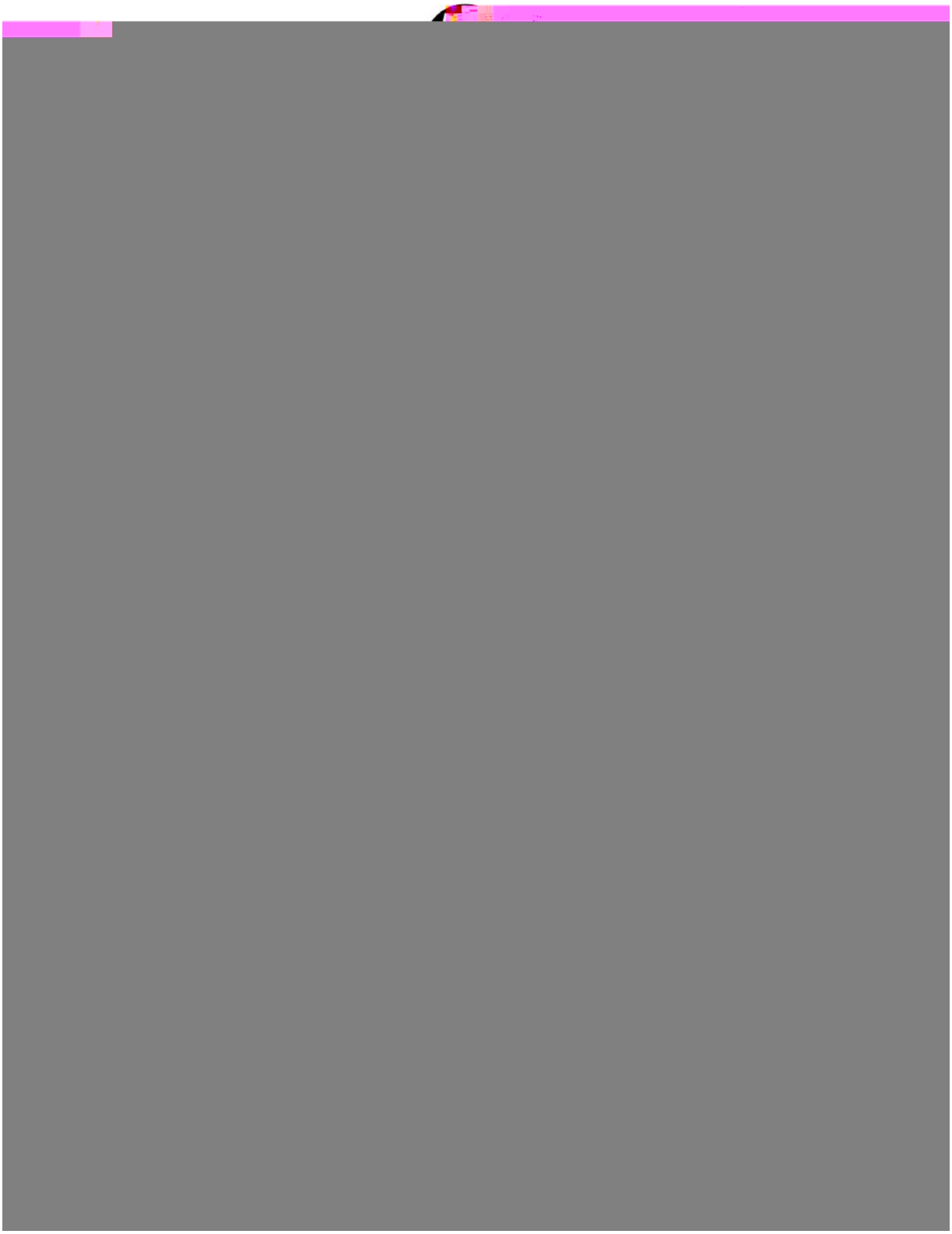

Figure 5–5. Diagram of lobby command post location inside World Trade Center 2.

Figure 5–6. Video image of the FDNY Fire Command Board located in the lobby of WTC 1.

FDNY Training Bulletin, Tools 22, December 1991[94] says the following about the Portable Command Post:

- The Portable Command Post (PCP) will be carried in the division vehicle. Deputy Chiefs shall utilize the PCP at fires, emergencies and other incidents where its deployment will assist the operation.
- The Portable Command Post will assist the Incident Commander in efficiently executing the responsibility of incident management.

The training bulletin highlights the following advantages of the Portable Command Post:

- Establishes a Fire Department Command presence at the scene.
- Serves as a physical focal point for incoming Fire Department Units as well as other agencies reporting to the operation.
- Provides a convenient means of direct radio communication with the Borough Communications Office.
- Facilitates the recording of the location and status of Fire Department units.

[94] FDNY Training Bulletin, Tools 22, December 1991 (See Appendix G).

- Facilitates the recording of the ranking official present from other agencies.
- When manned by an aide, the Incident Commander will be freed from the distraction of units and agencies reporting in to the operations.
- Satisfies federal regulation regarding the establishment of a Command Post.
- Provides own light for viewing and recording information.
- Improves safety by promoting accountability of personnel, efficient use of resources and tactical planning.
- As a visual aid the PCP will assist Incident Commanders in assigning Chiefs areas of responsibility.

The complete FDNY Training Bulletin, Tools 22, December 1991 on the Portable Command Post is reproduced in Appendix G.

The Command Board is used by Command Post personnel for logging in and assigning units for operations at an incident.[95] A FDNY interviewee indicated that on September 11, 2001, the Command Board approach to managing operations at the WTC became overwhelmed with the number of units and personnel reporting in for operations. In addition, the interviewee indicated that not all personnel that arrived at the WTC site were logged in on the Command Board.[96] This is partially due to the size and complexity of operations at the WTC, but it also relates to personnel not always following department policies on reporting to the Command Post for assignment. [97, 98]

Another problem related to accountability and tracking of personnel faced by the emergency responders as they arrived at the WTC site was that some emergency responders did not know which building was Tower 1 and which building was Tower 2.[99, 100] The towers were not well marked.[101] First-person interviews with firefighters coming in from other parts of the city showed that they were not familiar with the WTC site and did not know one tower from the other.[102, 103] Some units assigned to WTC 2 by dispatchers or from staging areas arrived at the scene and had to take time to find out which tower was which. Some of these units were approaching WTC 2 when it collapsed and members of their company survived. [104] Other firefighters that were interviewed and were assigned to work in WTC 2 went through WTC 3, the Marriott Hotel, and ended up inside WTC 1. They attempted to get to WTC 2 by following

[95] FDNY Training Bulletin, Tools 22, December 1991.
[96] FDNY Interview 65, spring 2004.
[97] FDNY Interview 65, spring 2004.
[98] FDNY Interview 63, spring 2004.
[99] FDNY Interview 65, spring 2004.
[100] FDNY Channel 7 / PA WTC Channel 30 radio communications recording.
[101] FDNY Interview 18, winter 2004.
[102] FDNY Interview 60, winter 2004.
[103] NYPD Interview 7, fall 2003.
[104] FDNY CD 12 (Chief's Report of Service at Fire) / CD 15 (Report of Company Operations).

the Concourse level to the building. [105, 106] Fortunately, this delay in getting to WTC 2 played a part in saving the lives of these firefighters when WTC 2 collapsed.

In general, FDNY units responding to the WTC followed good practices as related to reporting in and accountability. However, there were a few cases where individuals did not report in to the Command Post and became freelancers. Interviews with FDNY personnel showed that some fire department personnel came to WTC facilities without unit approval. In addition there were various emergency responders from NYPD and PAPD that entered the towers without reporting into the FDNY Command Posts. The following statements were taken from first-person interview notes:

- One FDNY interviewee said that there were a lot of guys freelancing at the WTC. Many of them were FDNY guys that were off duty and wanted to help, and they were coming into the buildings.[107]

- Another FDNY interviewee reported that he and three or four other firefighters from his company attempted to get from Brooklyn to Manhattan by crossing the Brooklyn Bridge. Some of the firefighters were stopped by FDNY Chiefs at the bridge staging area. The group got back together and hid in the back of an ambulance that agreed to carry them into Manhattan and to the WTC site.[108]

The account below by the PAPD officer suggests either their unfamiliarity with the FDNY operating procedures for high-rise fires and the function of the FDNY Lobby Command Post and that the firefighters in the lobby were awaiting check-in and assignment.

- One PAPD officer reported that his group went into the lobby of WTC 1 and that there were a lot of fire department units in there just standing around. The interviewee said that they could hear people screaming and that there were a lot of casualties in the sky lobby of the building. The interviewee remembered thinking "What is everybody standing around for?" The interviewee gathered up his team and started up stairs without reporting in to the FDNY Command Post.[109]

There also was at least one case where an NYPD team entered WTC 1 without checking in with the FDNY Lobby Command Post. Again, this may be attributed to the lack of knowledge on the part of NYPD personnel concerning FDNY operations in high-rise buildings. At approximately 9:22 a.m. a NYPD Emergency Service Unit (ESU) team reported to the WTC 2, FDNY Lobby Command Post and received an assignment to meet with and assist a Battalion Chief who was located on the 43rd floor of the building in stairway B. Evidence of this assignment was found on the recording of the FDNY high-rise radio repeater channel/PA/WTC Radio Channel 30. The radio communication provides significant details on this Command Post assignment. Also, an interviewee from the OEM staff indicated that he saw an ESU team enter WTC 2 and ordered them to report to the FDNY Command Post. The interviewee

[105] NYPD Interview 22, spring 2004.
[106] FDNY Interview 62, spring 2004.
[107] FDNY Interview 58, winter 2004.
[108] FDNY Interview 63, spring 2004.
[109] PA Interview 8, fall 2003.

indicated that the ESU team reluctantly complied with his order.[110] Data analysis suggests that this may be the same team that received the assignment to assist the Battalion Chief. It is critically important that emergency responder departments that work together have a good understanding of each other's operational practices as far as safety and personnel accountability is concerned.

It is clear that the NYPD and PAPD units that entered the buildings without reporting to the FDNY Command Post felt that they were conducting operations within the bounds of their responsibility and authority.[111] However, these police department units and other FDNY personnel who entered the buildings without being logged in with the Command Posts and receiving assignments created personnel accountability problems for FDNY.[112] At times, command personnel at a fire department command post have to make immediate decisions that may relate to the life safety of all personnel at an incident. These decisions often have altered the degree and direction of fire growth, and in some cases, emergency responders have died because the Incident Commander was not aware that the individuals were in the path of the altered and dangerous conditions.[113] In addition, fire can change in characteristics and in the direction of travel as a result of changes in building and/or weather conditions. Again, the Incident Command needs to know where all personnel are in order to carryout a successful and safer operation.

The collapse of WTC 2 seriously complicated the task of accountability and personnel tracking. When WTC2 collapsed, each of the three FDNY Command Posts and all of their data were lost. Information for unit and personnel assignments that were being maintained on FDNY's Fire Command Board disappeared into the rubble. There was no backup of these records at the site or at an offsite location.[114] This created a problem for FDNY when it came time to locate missing personnel.[115]

5.5.2 FDNY Recall Procedure

The following was extracted from the FDNY recall procedure (FDNY Regulations, Chapter 18, Recall, January 1997) [116] that was in effect at the time of the WTC attack:

The Recall Procedure:

- In the event it becomes necessary to augment temporarily the numerical strength of manpower on duty within the Department during actual or potential emergency conditions, the signal 65-2 will be transmitted under jurisdiction and authorization of the Fire Commissioner.

- Upon receipt of signal 65-2 transmitted to implement recall, chief and company officers shall follow instructions transmitted. Depending upon the area affected and the degree of

[110] FDNY Interview 54, winter 2004.
[111] NYPD Interviews 5 and 6, winter 2004.
[112] FDNY Interview 2, fall 2003.
[113] NYPD Interview 24, spring 2004.
[114] FDNY Interview 65, spring 2004
[115] FDNY Interview 65, spring 2004
[116] FDNY Regulations, Chapter 18, Recall, January 1997

necessity, the orders relative to scope of the recall will be announced over the Department radio, voice alarm, and by teleprinter messages.

- Recall may be total (city-wide) or partial (confined to one or more boroughs). It may affect all units or selected units, such as Engine companies only. The time frame may run from continuous duty to specific tours or hours.

Notification of Members:

- In those instances requiring a citywide recall, it shall be the responsibility of each member to monitor the news media and report for duty as required.
- In limited recall situations where media coverage may be limited officers on duty shall immediately notify affected off duty members as necessary.
- Commanding officers shall, in order to insure prompt telephone notification of off duty members, maintain a current and accurate personnel record of emergency telephone numbers in the office record journal.

The complete FDNY recall procedure (FDNY Regulations, Chapter 18, Recall, January 1997) is contained in Appendix H.

5.5.3 EMS Accountability, Location, and Tracking

The FDNY Chiefs who had responsibility for the Emergency Medical Services (EMS) response to the WTC developed a plan of action.[117] They divided the area into quadrants, set up staging, triage, and treatment areas. Inside those areas other FDNY EMS officers were sectoring the workload as described below. The following are statements extracted from EMS first-person interviews regarding EMS plan of action:

> ▪ I informed him that I was there as well and he had other representatives from the fire department. We started to set up our treatment and triage sectors as units were reporting in and officers were reporting in. Because of the large area involved, we sectored off different EMS areas in accordance with our incident command system where they functioned as teams so they could deal with patients as they come out of the complex. As I was doing that, a chief reported in and I asked him to become my operations officer so this way I could be involved and function as liaison with the incident commander. I recall speaking to a commissioner there because he had some questions as far as resources coming in and where they were coming from and how I was going to set up the EMS operation.[118]

[117] FDNY Interview 64, spring 2004.
[118] FDNY Interview 68, spring 2004.

- At this point we had quite a few FDNY EMS supervisors coming in. I happened to be the highest ranking officer in the area. There were no chiefs; it was me and some Lieutenants. As they came in, I started to assign them sectors to organize in the area; a transportation officer, a treatment officer, a triage officer among others. So we were using our triage tags and we're trying to separate the patients into different categories of priority and as ambulances were coming in, we'd load the most serious first to be taken away. We had little areas for people badly hurt people, right on the corner. We separated the area with tape to designate it as an area for patients and also to keep the flow of people from tracking through that area on their way out. So this corner was rapidly becoming overwhelmed with the amount of people coming out who were hurt. That was becoming almost 10 o clock. We had just really started getting a foothold on the patients; ambulances were coming in and going out. We were starting to get some organization of where the ambulance should park, then load up and leave. We were thinking about alternatives of patient transport because there were so many, maybe commandeering city busses. I asked the Lieutenant with the portable radios to request additional units as well as city busses to come and help us out.[119]

Several obstacles with regard to accountability of EMS personnel added to the Chiefs' difficulties. The first was the size of the event as it unfolded and the difficulty that EMS Chiefs had in determining who was at the scene.[120] The second was the "self dispatch" and "freelancing" of some non-FDNY ambulances.[121] The third was the inability of FDNY EMS supervisors to communicate with some of the non-FDNY ambulances.[122] The following are statements taken from first-person interviews:

- We turned and looked and there were two ambulances coming with stretchers from opposite directions. If they were ours I would have recognized them. I thought who is controlling these guys; we needed to get this under control.[123]

- I think the biggest problem at the World Trade Center was lack of control of non fire department personnel. City and private, we are supposed to be in control of them, even though they are supposed to listen to us, but it does not happen. It is hit or miss if a voluntary ambulance will follow your command. It is a safety issue for those units, on September 11, 2001, there were units that responded there that wanted to run in, I saw my guys stop them and tell them no, there were words exchanged, there was no time to argue the point.[124]

[119] FDNY Interview 49, winter 2004.
[120] FDNY Interview 50, winter 2004.
[121] FDNY Interview 51, winter 2004.
[122] FDNY Interview 64, spring 2004.
[123] FDNY Interview 40, winter 2004.
[124] FDNY interview 51, winter 2004.

- A few blocks up, it had gotten safer and some ambulances were coming in and I was trying to flag them down telling them not to go further because it was too dangerous. Some of them stopped, some of them didn't.[124]

- The private ambulance teams that responded had no equipment and no protective clothing at all. They also do not have the same radios so it was not possible to communicate with them via radio. Those who were in the EMS and mutual aid system did have radios that were operating.[125]

5.5.4 EMS Patient Tracking

There are many reasons to track patients that are triaged, treated, and transported from an emergency. One important reason is to ensure that no single medical facility is overwhelmed by an unexpected influx of patients.[126] At the scene of a mass casualty incident, an emergency medical services officer is usually designated the duty of seeing to it that no one hospital is inundated with patients beyond its capabilities. This emergency medical services officer often is called the "transport officer" within the incident command system. The "transport officer" not only helps to prevent overwhelming of each hospital but also ensures that each injured patient goes to a medical facility best able to treat the medical condition.[127] The objective is not having an ambulance drop a patient off at a hospital, but at a hospital that has the best capabilities to take care of that person. The following description of one of the triage areas was extracted from a first-person interview.

- At the triage area we basically triage and rapid transport with strict Mass Casualty Incident Protocol. The first arriving medical authority on the scene, the first EMT or Paramedic becomes the triage officer, and they are also in charge until an officer gets to the scene. Usually we try and turn it over to a paramedic officer. Then you have someone responsible to make sure the patients are triaged, and the treatment officer who stays in the treatment area determines what kind of treatment we give them. Then you would have the staging officer who would be responsible for ambulances, there is egress for them, there is ingress for them. The transport officer would work right were the patients are being loaded from the treatment area and direct what hospital the patients should be transported to. Normally patients are transported based on injury, closest trauma center, nearest 9-1-1 center, nearest burn center, etc. In times like this there are so many patients a lot of times you may overwhelm one hospital. What you need to do, for instance Saint Vincent's which is a trauma center, if there are too many patients there it might be worth sending patients somewhere else further away and they can get treated more quickly. I felt that when I got there some patients had been transported, that actually the patients were transported in a system. I was surprised that we were already sending people out to Brooklyn and stuff

[125] FDNY Interview 64, spring 2004.
[126] FDNY Interview 51, winter 2004.
[127] FDNY Interview 51, winter 2004.

> like that, which was really a good idea. At least we were thinking globally at that point.[128]

Within the individual triage and treatment areas that were set up it appears that efforts were made to keep track of patients. This was done with pencil and paper.[129] All the data on patients was lost when the buildings collapsed.[130] The loss of WTC 7, which housed the Office of Emergency Management (OEM), hampered the ability to track patients within the system.[131] One of the EMS Chiefs assigned to go to WTC 7 was inside the OEM when it was ordered evacuated, describes what the loss of OEM meant to them, not only for the ability to track patients but other aspects of command and control.[132] The following is taken from a first-person interview:

- My concern was if there were things needed by the Fire Department then I could get them from OEM. We had a lot of different tools available to us. We had 4 or 5 positions in the OEM Operations Center that were assigned to the Fire Department. We had the terminals where we could monitor the dispatch system, and patient tracking information. We had the EMS radio frequencies and their transmitting capabilities. We had a monitoring terminal for the fire dispatch system. We had all the fire radios as well. We had a lot of technology there to assist us, mapping capabilities and mapping files to show where our units are. We were at a disadvantage because we didn't have those tools. I would have had a better idea of what was going on.[133]

Another factor that had an effect on the FDNY's ability to track patients was the self-dispatch of some non 9-1-1 ambulances. The following was extracted from a first-person interview:

- Because of the self-dispatch of non 9-1-1 resources there were patients being removed from the location by those units, and the EMS officer did not know it. Normally, what we try to do with patient tracking is to get the information before the patient leaves the scene, but because of the way this operation developed, we had to put systems in place to retrieve the information from the hospitals.[134]

There also were people who transported themselves to the hospital.[135] Due to the size of the disaster and number of patients generated, medical aid was not confined only to one jurisdiction. This situation was much like the Sarin gas attack that occurred in Tokyo, Japan where injured people obtained medical aid from numerous medical facilities in various jurisdictions (Strasser 1995). The following was taken from an emergency responder first-person interview:

[128] FDNY Interview 51, winter 2004.
[129] FDNY Interview 51, winter 2004.
[130] FDNY Interview 51, winter 2004.
[131] FDNY Interview 45, winter 2004.
[132] FDNY Interview 45, winter 2004.
[133] FDNY Interview 45, winter 2004.
[134] FDNY Interview 50, winter 2004.
[135] FDNY Interview 50, winter 2004.

- Not all patients at the hospitals arrived by ambulance. Nor was this situation isolated to just New York City. Because of self-evacuation to Jersey and other Boroughs within the city people were just jumping on transit buses. We found out later that buses were just going to hospitals and dropping off patients. This may have caused some hospitals to have a lot more minor injuries to take care of at one time.[136]

5.5.5 NYPD Accountability, Location, and Tracking

Information in this section was drawn from first-person interviews with NYPD Special Operations Division, Emergency Service Unit personnel, NYPD Special Operations Division (SOD) Division radio communications and department documents.

The primary mobilization point for the NYPD Special Operations Division that sent Emergency Service Unit (ESU) rescue teams into the WTC was located at the corner of Church and Vesey Streets.[137] The post was managed by a SOD detective that had just gone off of duty and was still at his office when the attack occurred.[138] He traveled to the WTC with the on duty ESU team, and since he was not in full uniform, it was decided that he would manage the mobilization point for the operations in the towers. As the post was set up, the detective obtained information on the attack over the radio, began assembling ESU teams and then sent them into WTC 1 and WTC 2.[139] Only six ESU teams were dispatched from the mobilization point to the towers. Each team consisted of about five ESU personnel. Records for each team were written onto paper attached to a clipboard.[140]

A second SOD mobilization point was established at the corner of West and Vesey Streets.[141] This post operated in the same fashion as the first. However, this post was associated more with providing security for the site.[142] ESU teams that came to the WTC typically came to the mobilization points as teams with all members present. Since the NYPD efforts at the WTC were primarily focused on the aviation units and the ESU teams, there was not a large influx of people coming to the command post as was experienced by FDNY. Therefore, the tasks associated with personnel accountability, location, and tracking were not as complex as those experienced by FDNY. The mobilization point officer was able to maintain reasonable radio communications with all units assigned to duty at the site, and tracking problems were minimal until the collapse of WTC 2.[143] With the collapse of WTC 2, all written records were lost as the high winds and debris blew through the mobilization points.[144] Since NYPD had only a limited number of personnel actually operating at the site, managers of the mobilization points were able to easily reconstruct the lost data on their personnel.

[136] FDNY Interview 50, winter 2004.
[137] NYPD Interview 24, spring 2004.
[138] NYPD Interview 24, spring 2004.
[139] NYPD Interview 24, spring 2004.
[140] NYPD Interview 24, spring 2004.
[141] NYPD Interview 24, spring 2004.
[142] NYPD Interview 24, spring 2004.
[143] NYPD Interview 24, spring 2004.
[144] NYPD Interview 24, spring 2004.

5.5.6 PAPD Accountability, Location, and Tracking

Information in this section was drawn from first-person interviews with Port Authority Police Department (PAPD) personnel, radio communications recorded at the PAPD Police Desk, and Port Authority documents.

Immediately after PAPD officers reported the impact of the first aircraft into WTC 1, the PAPD police desk began a roll call to determine condition of their police officers and where they were located.[145] PAPD had the primary law enforcement responsibility at the WTC site and officers were working their assignments at the WTC when the attack occurred.[146] In addition, several PAPD teams were dispatched from various locations from around the city and from Jersey City to the site.[147] The PAPD officers who arrived at the WTC before the collapse of WTC 2 typically reported to PAPD personnel that were located at the WTC 1 lobby Fire Command Desk.[148] A PAPD Inspector was working at the command desk and was working with FDNY at their Command Post. This officer gave direction to incoming PAPD personnel.[149] The WTC Police Desk was located inside of WTC 5 and had a view of the Plaza area. PAPD operations for the WTC site were normally conducted from this location.[150] In addition, the WTC radio system was maintained at WTC 5 with antennas located on top of the building.[151] With the collapse of WTC 2, the PAPD Police Desk and Command Center was evacuated, and many of the emergency response records were lost. Police Desk communications tape recordings were recovered some days later.[152]

5.5.7 General Comments Concerning Accountability, Location, and Tracking

All of the emergency responder organizations that responded to the WTC on September 11, 2001, had accountability, location, and tracking plans in place, and they generally worked well during the first 30 minutes of operations at the WTC. However, the FDNY system became overwhelmed with the large number of units and personnel arriving at the WTC. The PAPD system became stressed with the collapse of WTC 2 and the loss of the WTC 5 Police Desk operations.

The location and tracking of personnel is an issue that has been studied by the emergency responder community for many years. Once responders report to a Command Post at the scene of an emergency, receive their assignments, and depart to accomplish their tasks, there is no positive means to locate and track the activities of the units or individuals. On September 11, 2001, the only means for locating and tracking units and personnel was through radio communications, and during operations there were so many people using the system for ongoing operations that the FDNY radio system and procedures were inadequate for locating and tracking personnel.[153] In addition, all three FDNY Command Posts and their

[145] PAPD Police Desk communications, Channel W, 2001.
[146] PA Interview 1, fall 2003.
[147] PA Interview 6, fall 2003.
[148] PA Interview 14, summer 2004.
[149] PA Interview 14, summer 2004.
[150] PA Interview 15, summer 2004.
[151] PA Interview 2, fall 2003.
[152] PA Interview 3, fall 2003.
[153] FDNY Interview 65, spring 2004.

Command Boards and the NYPD mobilization points with their records were destroyed, and all operations records were lost for the hundreds of emergency responders who were operating at the site, and there was no backup for these lost records.

Resources Available for Initial Situation Assessment and Incident Management, and Practices for Determining the Possibility of Structural Collapse

Information for initial situational assessment and "size-up" of an event begins with the fire department when the incident report is filed through the 9-1-1 emergency dispatch center or from an alarm received from a pull box at the scene (NFPA 1997) (Bush 1979). Information gained from these sources is the basis for information provided to the fire department responders when they are dispatched to an incident. On September 11, 2001, a FDNY Battalion Chief observed the first aircraft crash into WTC 1, and he immediately got on the radio and reported the aircraft crash to the FDNY dispatcher. In addition, he reported to the dispatcher that he and his companies were responding to the WTC.[154] The 9-1-1 emergency dispatch center began receiving telephone calls from citizens and Port Authority personnel concerning the attack and gathered additional information (NIST NCSTAR 1-7). As fire department companies received dispatch orders for the WTC, the FDNY dispatch center sent out a Critical Information Dispatch System (CIDS) message for the site.[155] This provided basic information concerning known hazards at the WTC site and was based on information from facility inspections that were done earlier.

The following information is based on first-person interviews with FDNY, Port Authority, and WTC personnel:

When the first FDNY units arrived at the WTC, the Battalion Chief went inside the building to the WTC 1 Fire Command Desk that was located inside the lobby. Information concerning building conditions related to fire alarm status and the activation of sprinkler systems were displayed on the wall panels behind the Fire Command Desk and on the Command Desk's computer terminal.[156] The former Deputy Fire Safety Director, who operated the Fire Command Desk, reported the building status as he understood it to the Battalion Chief.[157] The Battalion Chief inquired about elevator status and was told by a Port Authority employee that it appeared that no elevators were operating in the building. After a few minutes, other WTC officials arrived at the Fire Command Desk. The Battalion Chief then met with the WTC personnel as needed, the former Port Authority Fire Safety Director, and Port Authority Vertical Transportation personnel. The Vertical Transportation personnel worked with the elevator systems and reported to FDNY the locations of elevators where occupants were trapped.[158]

The following statement about initial "size-up" and building conditions was extracted from an FDNY first-person interview.

[154] FDNY Interview 7, winter 2004.
[155] FDNY Communications Manual, DCN: 3.01.01, January 1, 1997.
[156] FDNY Interview 7, winter 2004
[157] Other Interview 3, summer 2004
[158] PA Interview 5, fall 2003

- As the interviewee entered the door from West Street, he saw two very badly burned people lying on the floor. The lobby had been badly damaged. Some of the windows had been broken out, glass was on the floor, and marble from the walls had been broken and fell to the floor. The interviewee initially met with the former WTC 1 Deputy Fire Safety Director and received a report that fires were burning above the 78th floor. They began to set up the Command Post, and he again met with the former Deputy Fire Safety Director and asked about elevator status. He was told that no elevators were operating in the building.[159]

A senior-level Chief arrived, and the interviewee reported his findings. They discussed the rescue plans. The plan was to rescue people in the building who needed help, get people out of the building, and cut a way through the damaged floors above to create a rescue path for those trapped above the impact zone and fires in the upper part of the building.[160] Firefighters were sent upstairs in the building, accompanied by Chief Officers. The orders given were to go no higher than the 70th floor.[161] This would leave eight floors above them as a buffer. Initially, firefighters were ordered to take hose up with them for cutting through the fires on the floors to rescue the people above. Additionally, firefighters were told to go up and report their observations back to him since he didn't really know what the conditions were at the aircraft impact area.[162]

As described above, information was available during initial "size-up" that defined the building conditions, but details needed for refining FDNY operations were limited. As time passed, additional information came into the Command Post from radio communications, the Port Authority, and FDNY personnel.[163] However, some information did not get transferred to the FDNY Command Post inside WTC 1. The following comments from a 9/11 Commission hearing address this issue:

Chief Officer's Comment:

> "One of the most critical things in a major operation like this is to have information. We didn't have a lot of information coming in. We didn't receive any reports of what was seen from the helicopters. It was impossible to know how much damage was done on the upper floors, whether the stairwells were intact or not. A matter of fact, what you saw on TV we didn't have that information." (9/11 Commission 2004)

Another Chief Officer's Comment:

> "People watching on TV certainly had more knowledge of what was happening a hundred floors above us than we did in the lobby. Certainly without any information, without critical information coming in, it's very difficult to make informed and critical decisions without that information. And it didn't exist that day. Our communication systems

[159] FDNY Interview 7, winter 2004
[160] FDNY Interview 7, winter 2004
[161] FDNY Interview 7, winter 2004
[162] FDNY Interview 7, winter 2004
[163] FDNY Interview 7, winter 2004.

> were down. Our building suppression systems were down, the elevators, we had no video capability throughout the entire operation. (9/11 Commission 2004)

Other information that was not available to the FDNY command personnel was information on building conditions near the aircraft impact zones. One example is information transmitted to a family member over the telephone describing building conditions inside WTC 1. At approximately 8:58 a.m., a telephone call to a relative noted that the 92nd floor (just below the aircraft impact point) was flooding with water (NIST NCSTAR 1-7). This is one of the only piece of data that potentially supports the conclusion by FDNY that the water supply at the impact zone had been compromised, and this information was not available for FDNY command personnel.

As far as assessments related to the structural stability of the building were concerned, the WTC 1 Command Post knew that significant damage had been done to the building. [164] They knew that large fires were burning above them. Their firefighting experience led them to believe that the buildings would remain in place throughout their operations, but they did expect that there would be some localized collapse conditions in the impact zone and the fire zones. No one interviewed indicated that they thought that the buildings would completely collapse. This perception is reflected in the following first-person interview statement:

> - The issue of total structural collapse was not taken into consideration in the plan. Today it is. There was no information on the vulnerability of the buildings to total collapse. That type of information is needed on all operations today. There should be a guide for collapse of different types of structures, an assessment that is accessible but is secure. The question is, if you lose so many floors what is the condition of the building? The buildings should be rated for structural capability. NIST could help with this.[165]

5.6 FIGHTING LARGE FIRES ON THE UPPER FLOORS OF TALL BUILDINGS

Fighting fires in tall buildings is not the same as fighting fires in buildings that are less than 30 m (100 ft) high. The height of a building has a direct impact on the ability of fire departments to carry out successful operations, and each high-rise building has design factors that may alter the way firefighting operations are carried out. O'Hagan (O'Hagan 1977) discusses this in his book.

> "a high-rise building may be defined as one that lacks viable exterior access to the upper floors for firefighting, and in which firefighters must place almost complete reliance on the building's systems and components for fire suppression. This definition takes in all buildings in excess of 100 feet in height which are beyond the reach of the standard Aerial Ladder.

[164] FDNY Interviews 2, 7, and 20, fall 2003 and winter 2004.

[165] FDNY Interview 7, winter 2004.

> Since reliance must be placed on the building's integrity, this criterion suggests the mandatory use of fire-resistive construction. However, in New York and many other cities, fire-resistive construction is required in all buildings exceeding 75 feet in height. This difference does provide an additional margin of safety, but it also serves to illustrate the rather loose definition of a high-rise building. *From a fire fighting viewpoint, the distinguishing characteristic of a high-rise is its excess height which deprives a fire strategist of exterior attack and at the same time restrains his strategy to interior attacks from locations that are dictated by the building design."*

There are issues specific to fighting fires on the upper floors of high-rise buildings that become more challenging as building height increases. Generally, a firefighter can climb a stairway at a rate of about one floor per minute.[166] Climbing the stairs causes a significant physiological impact on firefighters wearing protective clothing and equipment, and carrying equipment needed for fighting fires and carrying out rescue operations. Fatigue becomes a factor after approximately 12 floors of climbing, and fatigue caused by climbing diminishes the functional capabilities of the emergency responder to carry out operations once they reach the fire floor.[167] Fire burning rates for different fuel loads and ventilation vary. A fuel load of about 48.8 kg/m^2 (10 lb/ft^2) with normal interior finishes, furnishings, and contents will take approximately one hour to burn out, depending on ventilation (Gross 1977). Without the use of elevators to access the floors just below the fire floor, it will take fully equipped firefighters carrying equipment approximately 60 minutes to get up to a fire on the 60th floor. In addition, it will take time to prepare the water supply - if there is one - and stretch hoselines for firefighting. Over this time period, the floor may have completely burned out, and the fire may have spread to other floors and other parts of the building.[168]

Even though the WTC towers contained large fires, very little firefighting was conducted during operations that morning. Analysis of electronic and interview data identified three cases where firefighting was carried out inside the WTC buildings before the collapse of WTC 2. They are as follows:

- Firefighters used handheld fire extinguishers to extinguish flames on people located in the lobby of WTC 1.[169]

- A Port Authority employee was using a fire hose to suppress a fire along a stairway wall inside one of the staircases in one of the WTC towers. (No tower or floor identification was available.) It was reported that the Port Authority employee indicated that he was going to keep trying to suppress the fire until the firefighters got there. Also, the Port Authority employee is credited with holding the flames in check to allow many people to get by on the stairway. It was stated that no one would have gotten out from this level if this man was not trying to control the fire and keep the staircase clear for evacuation (Atwell 2002).

[166] FDNY Interview 9, winter 2004.
[167] FDNY Interviews 1, 7, and 11, fall 2003 and winter 2004.
[168] FDNY Interview 11, winter 2004.
[169] FDNY Interview 13, winter 2004.

- At approximately 9:55 a.m. firefighters were attempting to stretch building hose lines in the "B" stairway on about the 78th floor of WTC 2 in order to extinguish two fires. The collapse of WTC 2 occurred at approximately 9:59 a.m.[170]

The challenge of firefighting at the WTC on September 11, 2001, was greater than any that had been experienced before.[171] The height and size of the fires in the buildings produced varying strategies related to how operations should be conducted. These strategies varied across a range based on the firefighter's years of experience, knowledge, and the quality of information they received. For complex operations to function smoothly, it is important that personnel working the task have an understanding of the mission and an understanding of the strategy applied for accomplishing the task.

5.6.1 Strategies for High-Rise Operations on September 11, 2001

According to the FDNY first-person interviews, there appear to be three approaches for the FDNY response to the World Trade Center. These different approaches are associated with the level of command responsibility for the different individuals at the WTC and are identified as follows: 1. Outside Command Post and Inside Command Communicating with the Outside Command Post, 2. Inside Command Post for Building Operations, and 3. Company Level Command.

Outside Command Post and Inside Command Communicating with the Outside Command Post

The approach to these operations by many of the Chief Officers appeared to be based on knowledge from the perspective of outside views and additional information that was being fed back from inside the buildings. Some Chief Officers in this category were totally aware of the nature of the multi-floor fires that were burning on the upper floors of the building. An understanding of the nature of multi-floor fires, the height of the fires in the building, the lack of adequate equipment and water in the building, and their experience over the years has shown that the extinguishment of high rise fires greater than 15,000 feet square on a single upper level floor is almost impossible (O'Hagan 1977). A Chief Officer referenced a 1977 publication on high rise firefighting by John T. O'Hagan, a former New York City Fire Chief and Fire Commissioner (O'Hagan 1977).[172] O'Hagan uses the World Trade Center fire of February 13, 1975, as an example in his book. This fire was located on the 11th floor of WTC 1 and consumed approximately one quarter of the floor. O'Hagan's analysis of this fire indicated that "If the east half of the building had been involved, it is unlikely that a direct attack would have been successful. In that case, we may have had to choose a defensive strategy." In this case, O'Hagan is referring to a fire that covered only one quarter of the 11th floor, a floor that is much more accessible than anything above the 77th floor where the aircraft struck the WTC buildings. Also, O'Hagan's reference to the "east half of the building" only refers to the east half of the 11th floor. This knowledge led some officers in this category to believe that the people above the impact zone and fires were not likely to survive, and that it would not be possible to rescue them before the fire gases and thermal conditions on the upper floors became

[170] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[171] FDNY Interview 2, fall 2003.
[172] FDNY Interview 20, winter 2004.

untenable.[173] In addition, the Chief Officers in this category, taking note of the large fires on these multiple floors and recognizing the impact of the structural damage, expected that there would be some localized structural collapses inside the building.[174] Communications between the Chief Officers at the Outside Command Post and a primary Chief Officer inside WTC 1 indicated that they recognized the possibility that a large portion of the top of the tower might collapse, breakaway, and fall into the streets below.[175] The following statements were extracted from FDNY Chief Officer interviews:

- Different Chief Officers would come into the building (WTC 1) from the Command Post outside mostly to discuss the possibility of collapse. There were discussions related to the collapse of not only portions of the buildings but also about the collapse of complete floors in the buildings. A Safety Chief came in one time and discussed the possibility of collapse. The feeling at the time was that there would be some type of collapse. There may be a collapse of the upper floors or an upper section of the building. No one envisioned the magnitude or the type of collapse that occurred and particularly at the early time that it occurred.[176]

- There were reports coming into the building (WTC 1) from outside that they all thought that there may be some form of collapse, local on a floor or a portion of the building falling into the street. There was no discussion of a total collapse of the WTC buildings.[177]

The experience and training of these officers, relative to past large high rise fires within the city or elsewhere in the world, did not lead the officers to expect a total collapse of either structure. Based on the above understanding, the Chief Officers in this category saw the operations at the World Trade Center during the first hours as strictly an attempt to evacuate occupants from below the fire floors, rescue trapped occupants from below the fire floors, and provide medical assistance to the injured.[178] This strategy is supported by the following statement drawn from the FDNY first-person interviews:

- The Chief at the Incident Command Post said that they were not going to be able to put the fire out and that they were just going to be saving people.[179]

Command Officers for Inside Operations

Generally, FDNY Command Officers who were planning for operations inside the towers saw the unfolding building and operating conditions from the perspective that the fires on the upper floors were too large to extinguish. For some of these officers, the goal was to get enough equipment and personnel up stairs to use hose lines to cut safe zones through the multi-floor fires to get to the upper floors for

[173] FDNY Interview 2, fall 2003.
[174] FDNY Interview 20, winter 2004.
[175] FDNY Interview 2, fall 2003.
[176] FDNY interview 20, winter 2004.
[177] FDNY Interview 2, winter 2003.
[178] FDNY Interviews 2, 7, and 20, fall 2003 and winter 2004.
[179] FDNY interview 45, winter 2004.

rescuing the hundreds of people trapped above the impact zone and fires.[180] These officers also knew that it was unlikely that they would be able to control the multi-floor fires over the short term.[181] However, they felt that they could cut a safe path through to make the rescues.[182] These officers also expected that there would be localized collapse conditions on the damaged fire floors. The officers did not expect that there would be any massive collapse conditions or complete building collapse.[183]

Company Level Command

Although FDNY Company Officers were given information defining their mission at the WTC, several of them saw the event as a very large and dangerous yet still conventional high rise fire.[184] Their approach to the fire conditions inside the building was to get up to the fire as soon as possible, put the fire out, and get ready for their next assignment.[185, 186, 187] This approach was based on their normal company operations, and was generally compatible with the expected mission.[188] These officers believed that there would be some localized collapse conditions at the impact zone and at the fire floors. They did not expect a massive collapse of the structures.[189]

These three operations strategies highlight differences that may be attributed to years of experience, level of training, and institutional focus of the various command levels. As the senior command level operational strategies were communicated to the lower levels, the concepts appeared to take hold at a slower pace at the next level down. Some firefighters at the Company level were disturbed by the operations orders that signaled a change toward assisting with the evacuation. They wanted to go up and put the fires out.[190] It is possible that the orders to assist with the evacuation saved the lives of many more firefighters. This was because the orders may have resulted in fewer firefighters being assigned to firefighting preparations on the upper floors.

5.6.2 Fighting Fires on the Upper Floors of the WTC

On the morning of September 11, 2001, FDNY was faced with the possibility of having to extinguish multi-floor fires in both towers of the WTC. In high-rise buildings, fire departments must rely on the building design, fire suppression systems, ventilation control systems, fire pumps, and standpipe systems to assist them with controlling and extinguishing fires. Fire pumps and standpipe systems must be able to provide enough water flow to extinguish any fires beyond the reach of apparatus operating from ground

[180] FDNY Interview 7, winter 2004.
[181] FDNY Interview 2, fall 2003 and FDNY Interview 20, winter 2004.
[182] FDNY Interview 7, winter 2004.
[183] FDNY Interview 2, fall 2003.
[184] FDNY Interviews 16, 18, and 27, winter 2004.
[185] FDNY Interview 41, winter 2004.
[186] FDNY Interview 35, winter 2004.
[187] FDNY Interview 9, winter 2004.
[188] FDNY Interviews 16, 18, and 27, winter 2004.
[189] FDNY Interviews 27 and 66, winter and spring 2004.
[190] FDNY Interviews 31, 55, and 57, winter 2004.

level. On September 11, 2001, the initial "size-up" indicated that the buildings' sprinkler systems were not working or controlling the fires and that the standpipe systems were inoperable at the impact zones.[191]

The following information concerning firefighting water supply systems at the WTC are based on a first-person interview:[192]

It was understood that the WTC fire pump system was functional, at least until the collapse of WTC 2. The damage to the standpipe systems in each building meant that significant work would be needed to reestablish a functional water supply that could have been used for firefighting. In addition, since both towers shared the same reserve water tank system and both towers sustained damage to their standpipe systems, a person who worked at the WTC would have to go to and manually close an isolation valve located between the buildings in order to get the fire pump system prepared for operation. Also, several WTC employees would have to go with FDNY up into the building to assist with sealing the broken standpipe system and to operate the various fire pumps, hand valves, gravity water tanks, and booster pumps needed for firefighting operations on the upper floors. At the point in time when WTC 2 collapsed, WTC personnel had not accomplished tasks required for operating the building's fire pump systems, and WTC personnel had not given orders for starting the building's fire pump system.

The discussion below provides some insight into firefighting operations that may have been carried out if the WTC towers had not collapsed.

In Section 5.2 of this report, it was estimated that it would take a water flow rate of approximately 4,700 l/min (1,250 gal/min) to extinguish one-half of a floor that would be burning inside one of the WTC towers. This amounted to approximately five 63.5 mm (2.5 in) diameter hoselines using nozzles with a 28.5 mm (1.125 in) tip diameter. For a full size floor on fire in one of the WTC towers, it would take approximately twice this flow rate, 9,400 l/min (2,500 gal/min), with a total of approximately 10 hoselines to extinguish the fire. This type of operation would likely involve a minimum of 15 to 20 Engine companies that would typically be able to work for periods of between 15 to 20 minutes before they would have to be relieved. This estimate for the extinguishment of a full floor fire at the WTC is based on operations under ideal conditions where the building's fire pumps would be supplying adequate water supplies for firefighting. If a building's fire pumps are not functioning, the fire department must rely upon its own resources. Special high-rise pumper apparatus would have to be coupled with the building's standpipe system to provide water supply for the upper floors.

5.6.3 Elevator Access and Evacuation

Elevators often are an integral part of high-rise building firefighting. They are relied upon by fire departments for transporting personnel and equipment up inside tall buildings. Over the years, elevator companies have improved the technology of high-rise building lift systems, but many fire departments still do not trust elevators to carry out critical tasks in high-rise buildings when human safety is the highest priority (Klaene 2001). Also, building code developers have been attempting to address the difficult issues of making elevator usage safe for emergency responders during firefighting operations

[191] FDNY Interviews 2, 7, and 20, fall 2003 and winter 2004.
[192] Other Interview 7, fall 2004.

through the consensus process (Winslow 2003). Many elevator components are susceptible to damage from fires, smoke, water, and earthquakes (NFPA 2003). Emergency responders will not use systems with limited safety margins when lives are at stake (Klaene 2001). FDNY recognized these issues and discussed them in their training bulletin, FDNY DCN: 3.02.17 Training Bulletin Emergencies 1, entitled, Elevator Operations, dated March 15, 1997[193]. In addition, the following general procedures taken from the bulletin describe FDNY procedures for elevator operations during fires:

General Procedures for Elevator Operations during Fire Operations

- Account for all elevators serving the fire floor, checking them for victims.
- When it is confirmed that the fire is on the 7th floor or below units should avoid the use of elevators. It is safer to utilize the stairway to reach the fire floor.
- Do not use an elevator in a bank which services the fire floor if a lower bank of elevators reaches within five floors of the fire floor.
- When it is necessary to use an elevator in a bank which serves the fire floor:

  If Firemen Service is available, use a car with the Firemen Service feature. (Note: This feature is required in many elevators which enables the fire department personnel to gain exclusive control of the elevators.)

  Select a floor at least two floors below the fire floor or two floors below the lower level of an access stair in the fire area, whichever is lowest.
- A service elevator shall not be used until it is declared safe for use by the officer in command of the fire. Be aware that in many high rise office buildings the service elevators have been converted for Firemen Service. Use of such an elevator must be avoided until declared safe by the officer in command.
- There must be a member equipped with a handie-talkie in each car whenever the elevator is in use.
- Not more than six members are to be permitted in any elevator car. This precaution is required to prevent overloading.
- Forcible entry tools must be carried aboard each elevator car.
- Elevator should be stopped every five floors (precautionary stops) to confirm that the elevator will respond to the selected floor. At each stop a new selection must be made.

The complete FDNY DCN: 3.02.17 Training Bulletin Emergencies 1, entitled, Elevator Operations, dated March 15, 1997, is reproduced in Appendix D.

[193] FDNY DCN: 3.02.17 Training Bulletin Emergencies 1, entitled, Elevator Operations, dated March 15, 1997.

The following is drawn from Port Authority and FDNY first-person interviews, and FDNY high-rise radio repeater communications:

There were 99 elevators inside each of the WTC towers for a total of 198 elevators.[194] Port Authority vertical transportation personnel began an evaluation of elevator operations immediately after the aircraft hit the towers. This was done by checking the elevator operations panels at the Fire Command Desk and calling the elevators using the elevator intercom phones.[195] Their initial analysis indicated that no elevators were operating in either building, and this was reported to the FDNY Chiefs running the building Operations Posts in the lobbies.[196] [197] Therefore, the fire department did not direct any personnel to use any elevators for operations inside of WTC 1. Some FDNY personnel went to the elevator banks in the building and personally checked the elevators.[198] Out of the 99 elevators that were located inside each of the two buildings, FDNY personnel found that only one elevator in WTC 1 and one elevator in WTC 2 appeared to be working.[199] [200] The Port Authority vertical transportation personnel and FDNY Command Post staff were unaware of the elevator that was operating inside of WTC 1.[201] This elevator was staffed by a WTC building Elevator Starter. The Elevator Starter took a small number of FDNY personnel up to the 16th floor using this elevator.[202] It does not appear that information about this operating elevator was ever reported to the FDNY Operations Post or the PA vertical transportation personnel that were operating in the lobby. Other emergency responders who saw that the elevator was operating did not trust it and chose to climb the stairs. The following is a statement made during a first-person interview by a PAPD Officer concerning the use of elevators inside of WTC 1:

- We were in a situation that was so desperate that I was not comfortable taking the elevator from the 1st to the 44th floor. There is no way I would use it, I know the dangers of a dead elevator.[203]

Under normal circumstances, the 50 Car elevator would be used by FDNY for access to the upper floors inside WTC 1.[204] The 50 Car elevator had access to all floors in WTC 1 and was a large capacity utility elevator.[205] During an interview, a contract employee at the WTC described what happened with the 50 Car elevator and why it was not available for use by the fire department. The following information is drawn from the first-person interview:

- The employee was working on the 7th floor of WTC 1 when the aircraft hit the building. The building shook and continued to shake. The interviewee said that the 50 Car elevator shaft was located just beyond

[194] PA Interview 5, fall 2003.
[195] PA Interview 5, fall 2003.
[196] PA Interview 5, fall 2003.
[197] PA Interview 13, fall 2003.
[198] FDNY Interview 25, winter 2004.
[199] FDNY Interview 25, winter 2004.
[200] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[201] PA Interview 5, fall 2003.
[202] FDNY Interview 25, winter 2004.
[203] PA Interview 10, fall 2003.
[204] FDNY Interview 42, winter 2004 and Other Interview 3, spring 2004.
[205] PA Interview 5, fall 2004.

> the room's wall where he was working. He heard the elevator falling and fly past his location. He heard people inside the elevator when it went past him. Then he heard the elevator crash to the bottom of the shaft, and he heard the elevator cables falling down the shaft after the 50 Car fell. A second explosion followed, and something came through the wall of the room. A fireball came into the room from the elevator shaft. The building had moved, and the room's door became jammed. Fire gasses that came into the room took his breath away, and when the interviewee finally got out of the room he collapsed on the corridor floor. Building occupants helped him up and helped to carry him out of the building. Two of the interviewee's associates were injured by flying concrete block on the B2 and/or B4 levels when the 50 Car elevator crashed to the bottom of WTC 1.[206]

In addition to the loss of lives and injuries caused when the 50 Car elevator fell, the loss of this elevator seriously hindered FDNY operations inside WTC 1. The primary means of transportation to the upper part of WTC 1 was no longer available.

Inside WTC 2, Port Authority vertical transportation personnel also evaluated elevator operations.[207] An FDNY firefighter found that one elevator was working from the lobby and that it would go up to the 40th floor.[208] Information about this elevator was reported back to the WTC 2 Operations Post located at the building's Fire Command Desk. This elevator was put into use and was used to shuttle personnel and equipment up to the 40th floor. The elevator operated until just prior to the collapse of WTC 2.[209] A firefighter who was operating the elevator became trapped in it just prior to the building collapse. At approximately 9:57 a.m., a FDNY radio communication over the high-rise repeater channel reported that firefighters were trapped inside the elevator that was being used to carry personnel and equipment up the 40th floor inside WTC 2. FDNY also used the elevator to carry injured building occupants to the lobby.[210] The radio message also stated that they were chopping through the wall to get out. WTC 2 collapsed about two minutes later. This radio communication may also have been heard by a FDNY Chief Officer who was working inside of WTC 1. The following was extracted from a first-person interview related to the emergency response:

- Another I remember, I believe I heard over the radio that a Truck Company was stuck in an elevator. There was a lot of traffic going on, on the radio, but you key into companies you know. I tried to contact the one guy who was trapped in the elevator and I couldn't get to him, but I could hear him calling for help. Sometimes you can transmit or you can just receive.[211]

The following information is based on first-person interviews with Port Authority personnel:

[206] Other Interview 7, fall 2004.
[207] PA Interview 5, fall 2003.
[208] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[209] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[210] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[211] FDNY Interview 25, winter 2004.

Port Authority personnel indicated that they were able to identify three elevators in WTC 1 that contained people.[212] One elevator had 4 people, one elevator had 1 person, and one elevator had 9 people. FDNY personnel were directed to each of the elevators. The elevator with 9 people in it was located on the ground floor. It is believed that the people in this elevator were rescued. Port Authority employees on the upper floors of WTC 1 found two men trapped in an elevator on the 71st floor[213] (NIST 2004). The elevator doors were jammed, and they had no tools to get the men out. Two of the rescuers went up to the 73rd floor to get tools that could help. After returning with the tools the two men were rescued from the elevator.[214] The status of the other elevators containing people is unknown.

Elevator checks were made on all Zone 1 and Zone 2 elevators inside WTC 1 before WTC 2 collapsed.[215] Elevator checks had started on Zone 3 at the point of building collapse. In Zone 3, banks B, C, and D did not show any signals on the elevator panel at the Fire Command Desk in the lobby of WTC 1 and were assumed to be inoperable.[216] (Note: Each of the WTC towers was divided into three vertical zones. Zone 1 reached to the 43rd floor. Zone 2 reached from the 44th floor to the 77th floor, and Zone 3 went from the 78th floor to the top of the building.)

Inside WTC 2, it was reported that when the aircraft struck the building one elevator with 18 people in it became stuck in the shaft.[217] It is unknown if this was the elevator that was reported to be stuck near the 78th floor. The final status of this elevator and its occupants is unknown. This radio report was received by a PA technical specialist located inside WTC 1 at the lobby elevator panel and was received from his PA counterpart in WTC 2.[218] No further information is known.

Based on the first-person interviews with FDNY personnel and the high-rise radio repeater recording, FDNY personnel who used each of the single elevator cars inside each of the towers basically followed fire department protocol. [219, 220] However, the elevator operation to the 16th floor of WTC 1 was never reported to the building's FDNY Command Post.[221]

5.6.4 Stairways, Access and Egress

Stairs were the primary means of access to and egress from the World Trade Center towers after the aircraft impact. Elevator service, practically speaking, did not exist in either of the buildings. As stated earlier, only one elevator functioned in each of the towers, and they only functioned in a limited capacity to the lower third of each building. This lack of available elevators forced emergency responders to use the stairways for building access. The effect of building evacuees and emergency responders using the same stairways for egress and access (counterflow) was studied by NIST's Project 7 investigators. This

[212] PA Interview 5, fall 2003.
[213] Building Occupant Interview 1000118.
[214] Building Occupant Interview 1000118.
[215] PA Interview 5, fall 2003.
[216] PA Interview 5, fall 2003.
[217] Port Authority, WTC Security radio channel X, communications recording.
[218] PA Interview 5, fall 2003 and PA Interview 13, fall 2003.
[219] FDNY Interview 25, winter 2004.
[220] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[221] FDNY Interview 25, winter 2004.

study is reported in NIST NCSTAR 1-7, Federal Building and Fire Safety Investigation of the World Trade Center Disaster, Occupant Behavior, Egress, and Emergency Communications. This document states that few building occupants felt that counter flow on the stairways had much effect on their evacuation. In contrast, many emergency responders suggested that counter flow on the stairways in WTC 1 generally had a negative impact on the emergency responder operations. Emergency responders reported difficulties negotiating the stairways as occupants were coming down. A sample of emergency responder comments concerning stairways and counter flow is located below.

Some of the problems experienced by emergency responders are as follows:

- Difficulty accessing the stairways at the lobby and mezzanine levels because of building occupant flow out of the stairway doors,
- Firefighter company personnel and police officer team personnel became separated from their colleagues by the counter flow as building occupants moved down the stairs and the emergency responders attempted to move up, and
- Emergency responders experienced difficulty moving equipment up the stairs as building occupants were coming down the stairs.

The following are supporting statements made by emergency responders about the stairs and problems with counter flow on the stairs:

- You could fit two people abreast on the stairs, one going down and one going up. It was just slow going up because of the lack of room. In my opinion, they should have had wider staircases. I do not think anyone anticipated this.[222]
- It was a single file up and a single file down, I am not an architect but this was not sufficient.[223]
- The building intercom system was not working after the plane hit. Normally, announcements over the intercom would tell people to use a different stairway when they were going down.[224]
- With all the people going the other way on the stairs, even if you were a marathon runner, you are not going to get very far.[225]
- We didn't know how long it would take us to get up to the 70th floor. You never know with the people coming down and if you had to fight the crowds. That takes a lot out of you sometimes.[226]

[222] FDNY Interview 43, winter 2004.
[223] FDNY Interview 52, winter 2004.
[224] FDNY Interview 43, winter 2004.
[225] FDNY Interview 29, winter 2004.
[226] FDNY Interview 37, winter 2004.

Figures 5–7 through 5–10 show an occupant and a firefighter carrying a length of hose passing on a 1,118 mm (44 in) wide stairway. The Figures also show a firefighter and occupant passing at the landing. Note that the stair width does not provide adequate space for the individuals to pass without hitting each other. This occurs on the stairway as well as on the landing when the firefighter makes the turn to start climbing the next flight of stairs.

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–9. Front view of occupant and firefighter passing on landing.

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

It was stated during the emergency responder interviews that the 1.12 m (44 in) wide stairways could be easily blocked by one person as they attempted to walk down the stairs.[227] An average-sized person could walk down the center of the stairway and place one hand on each of the staircase hand rails. This posture would successfully block the stairway for other people who were moving faster down the staircase.[228] This posture was identified as being used by mobility impaired people who were only able to step down

[227] FDNY Interview 42, winter 2004.

[228] FDNY Interviews 41 and 42, winter 2004.

to the next step one foot at a time, which resulted in both feet standing on the same step, instead of the unimpaired gait where one foot is placed onto a step and the other foot is placed on the next step down.[229]

Emergency responders also reported that the stairways became plugged and traffic was stopped as individuals with other physical disabilities or significantly overweight occupants blocked the stairs as they were attempting to evacuate. A building occupant reported that as he went down the stairs between the 50th and 43rd floors there was a steady flow of firefighters going up the stairs spaced about two feet apart vertically on the stairs (NIST 2004). At about the 45th floor, the occupant encountered a group of slow moving elderly people who were mobility challenged[230] (NIST 2004).

The following is a sample of statements from FDNY and PAPD emergency responder personnel concerning people who were mobility challenged:

- At the 27th floor I ran into a guy in a wheel chair with his friend. He was waiting for the crowds to clear so that he could make it down the stairs.[231]

- Inside the stairway in WTC 1, it was strange, people were still coming down as we were evacuating. More incapacitated people, they were holding people up. How were we going to move these people? We didn't want to hold people up. That is how I got separated. We were letting people go by us.[232]

After WTC 2 collapsed, FDNY personnel inside WTC 1 attempted to exit the building by going down the various stairways. On the way down, some of the emergency responders stopped and checked each floor to be sure that it was clear before they proceeded down. On about the 12th floor, FDNY personnel found approximately 40 to 60 people who had been removed from the stairway by others and placed onto the floor because the mobility impaired individuals had been blocking the stairway evacuation routes. These people were mostly physically challenged building occupants and significantly overweight occupants who were having trouble going down the stairs.[233] The emergency responders stopped and began to assist these people with their evacuation. Depending on the disability or size of the mobility challenged person, it took from one to four emergency responders to assist one person with the evacuation. If the individual being provided aid required a lot of assistance or was significantly overweight, emergency responders had to change teams with those assisting as fatigue set in.[234] The evacuation pace while assisting the mobility challenged occupants was often described by the emergency responders as very slow.[235] One well-publicized case involved a mobility challenged occupant, several firefighters, and a PAPD officer who were trapped inside a staircase when WTC 1 collapsed. These emergency responders were able to extract themselves from the collapsed staircase and were assisted by other firefighters as they crossed the rubble

[229] FDNY Interview 39, winter 2004.
[230] Building Occupant Interview 1000118.
[231] PA Interview 10, fall 2003.
[232] FDNY Interview 41, winter 2004.
[233] FDNY Interview 25, winter 2004.
[234] PA Interviews 7 and 8, fall 2003.
[235] FDNY Interview 56, winter 2004.

pile.[236, 237, 238] The occupant was taken from the rubble pile by firefighters that came to the person's aid. From the FDNY and PAPD interviews, it was not clear how many of the 40 to 60 occupants were safely evacuated from the building before WTC 1 collapsed. It is known from the interviews that a group of about 20 of these individuals were being moved out of WTC 1 just before the building collapsed.

Another problem reported with the stairways in WTC 1 and to a slightly lesser degree in WTC 2 during the evacuation was that the stairways in the impact zone were damaged, and the stairways above the impact zone were typically filled with smoke and hot gases (NIST NCSTAR 1-7). The stairways were functioning as chimneys for the fire gases and smoke that blocked the evacuation routes for the occupants above the impact zones. Several occupants inside WTC 2 above the impact zone found that stairway A, for a period of time, had a smoke level low enough for them to successfully escape from the upper floors. For additional information see NIST NCSTAR 1-7, section 8.1, and NIST NCSTAR 1-7B. Also inside WTC 2, FDNY personnel reported over the radio that stairway walls were breached from the aircraft impact on the 68th, 73rd, and 74th, floors.[239] It should be pointed out that the aircraft struck WTC 2 between the 77th and 85th floors (NIST NCSTAR 1-5A).

Another problem with the stairways occurred when WTC 2 collapsed. As WTC 2 collapsed, the stairways in WTC 1 became filled with dust and smoke, reducing visibility to near zero.[240] It was reported that emergency responders with flashlights could get near the floor and see the steps and floor that were painted with photo-luminescent paint, marking the stairway routes. They could also see the reflective exit signs.[241, 242] Figure 5–11 shows an identical staircase with painted floor markings that was located in the sub-grade level of WTC 4. This photograph was taken in one of the WTC 4 stairways several months after the WTC attack in 2001.

The following first-person interview statements provide insight into how emergency markings and exit signs helped to save lives:

- One piece of equipment that I carried was a small Mag-Light. It was enough to illuminate the reflective markings on the stairs.[243]

- My flashlight saved my life with the reflective exit signs leading to the outside.[244]

It also was noted that on about the 3rd floor of WTC 1, where water had entered the stairway from broken pipes or discharged sprinklers, the water mixed with the dust and the floors became very slippery, causing emergency responders to fall as they went down the stairs.[245]

[236] PA Interview 10, fall 2003.
[237] FDNY Interview 25, winter 2004.
[238] FDNY Interview 56, winter 2004.
[239] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.
[240] PA Interviews 6, 7, and 8, fall 2003.
[241] PA Interview 6, fall 2003.
[242] PA Interview 1, fall 2003.
[243] PA Interview 6, fall 2003.
[244] PA Interview 1, fall 2003.

Source: NIST.

Figure 5–11. Photograph of a typical World Trade Center staircase, sub-grade level of WTC 4.

As the emergency responders approached the lobby level on several of the stairs they found them blocked by debris generated when WTC 2 collapsed.[246] Some of the emergency responders were able to move debris and get past it, and others tried to find different routes out of the building.[247] Interviews with FDNY and PAPD personnel indicated that a firefighter with an axe cut a hole in a wall to allow them to escape out of the stairway.[248] Two PAPD personnel reported that they were trapped inside WTC 1 and used their service pistols to shoot windows out so that they could get out of the building.[249] A NYPD officer also used a service pistol to shoot a window out in an attempt to escape the collapse.[250] This was done when an NYPD Special Operations Unit team was trapped near the front of WTC 7 and a window was shot out in an attempt to form an exit route through the WTC 7 building.

[245] PA Interview 9, fall 2003.
[246] PA Interview 7, fall 2003.
[247] PA Interview 6, fall 2003.
[248] PA Interview 7, fall 2003.
[249] PA Interview 9, fall 2003.
[250] NYPD Interview 8, winter 2004.

5.6.5 Physiological Impact on Emergency Responders and the Effectiveness of Conducting Operations

Since the elevators were not functioning or safe to use, firefighters had to climb the stairs in order to assist with the evacuation and rescue building occupants. Many of these firefighters were carrying additional equipment with them that would be needed for conducting rescues and firefighting.

A normally outfitted FDNY firefighter wearing a full protective clothing ensemble (coat, pants, helmet, hood, boots, and gloves) and a SCBA (self-contained breathing apparatus) carries approximately 23 kg (50 lb) of gear (Lawson 2000). This does not include any additional tools, radios, lights, extra air bottles, medical kits, or hose packs that may be carried by a firefighter. This additional equipment that may be carried by a firefighter may add another 23 kg (50 lb) or more to the work load. It is not unusual for firefighters to be carrying loads in excess of 46 kg (100 lb) into a building when fighting a fire.

On September 11, 2001, firefighters who responded to the World Trade Center carried these loads as they ascended the stairways in the buildings. At a minimum, firefighters with only their protective clothing ensemble and SCBA carried approximately 23 kg (50 lb) of equipment up the stairways. This extra weight has a serious impact on the physical capabilities of firefighters or any emergency responder trying to climb stairs. The following first-person interview statements address the issue of equipment weight:

- I'm surprised I made it up to the 30 floors. It's heavy, bulky, hot and sweaty. The most that we could do was 10 floors at a time. I think that we were taking about 100 extra pounds of weight: heavy boots, bunker pants, tanks on your back and tools in your hands and a heavy helmet on your head.[251]

- We were all carrying one roll up. I needed a little more time to recuperate. We figured that if two guys carried one roll up, we would make better time so we left two fire hoses on the 31st floor. The guys were so fatigued carrying all the stuff. It took about an hour to get to the 31st floor[252]

- It is tiring climbing the stairs. I carried about 105 lb with bunker pants, tools and water can. You have got to keep things light.[253]

The Figure 5–12 shows FDNY firefighters in the lobby of WTC 1 and the equipment they carried.

[251] FDNY Interview 17, winter 2004.
[252] FDNY Interview 39, winter 2004.
[253] FDNY Interview 42, winter 2004.

Figure 5–12. Video image showing FDNY firefighters inside the lobby of WTC 1 with protective clothing and extra equipment carried for operations inside the building.

A basic rule of high-rise firefighting mentioned by emergency responders during the investigation indicates that, a fully equipped firefighter can climb approximately one floor per minute.[254] This means that it would take a firefighter approximately one hour to climb to the 60th floor. However, some firefighters estimated that it would have taken them as long as two hours to climb to the 70th floor where FDNY was planning to establish an Operations Post.[255] Some FDNY personnel that were interviewed by NIST and were inside WTC 1 had heard that a small number of FDNY rescue personnel had climbed to about the 50th floor in WTC 1 before WTC 2 collapsed.[256] This was also reported by a building occupant who stated that as they evacuated down the stairs, "We saw distressed firemen around the 50th floor"[257] (NIST NCSTAR 1-7). Inside WTC 2, a FDNY Chief Officer reached the 78th floor just before the building collapsed. This climb included a trip on an elevator up to the 40th floor before the FDNY Chief began to climb the remaining 38 floors using the stairs.[258] This officer was noted to be a marathon runner, and during his climb up the stairs he was likely wearing an SCBA breathing apparatus but was not carrying extra firefighting equipment. For additional information on the locations of interviewed personnel inside WTC 1, see Section 5.7, Table 5–1.

[254] FDNY Interview 29, winter 2004.
[255] FDNY Interview 16, winter 2004.
[256] FDNY Interviews 20 and 54 winter 2004.
[257] Building Occupant Interview 1000118.
[258] FDNY Channel 7 / PA, WTC Channel 30 radio repeater communications recording.

Interviews with FDNY, PAPD, and NYPD personnel identified the following concerning climbing the stairs inside WTC 1 on September 11, 2001:

Initial Climbing Period

- Firefighters were able to climb the first 10 to 12 stories in 2 to 5 minutes. The climbing rate depended upon the individual's physical condition and the amount of equipment being carried.

- After the first 10 to 12 floors the firefighters had to stop and rest.

Supporting First-Person Interview Comments:

- We started taking breaks around the 9th floor, and then started marching up again. One of our guys had some chest pain. We made another few flights and he got worse.[259]

- Climbing was tough but orderly. Carrying equipment was a strain. The first 12 floors felt like I had climbed 100 floors[260]

Repetitive Climbing and Rest Periods

- After the rest period that may last several minutes the firefighters would climb again, but this time they would usually complete only 5 to 6 floors before they would have to stop and rest again.

- After resting again the firefighters would again climb another 5 to 6 floors and rest again. Some individuals would only make about 3 to 4 floors before having to stop for a rest.

Supporting First-Person Interview Comments:

- A lot of companies had taken rests at about every 4th or 5th floor because we kept passing one another. It was very hot in the stairway, especially with all your gear and hood on, with no ventilation. I ended up going up to the 19th floor.[261]

- Our crew made it up to 21 or 22. I was not exhausted, but it was taking a toll. If we had to go another 20 flights we would have to take longer rest breaks. With us going up about five flights of stairs at a time it would have taken us about two hours to get to the 70th floor.[262]

[259] FDNY Interview 35, winter 2004.
[260] PA Interview 6, fall 2003.
[261] FDNY Interview 27, winter 2004.
[262] FDNY Interview 16, winter 2004.

Physical Impact of Climbing: Fatigue, Heat Stress, and Dehydration

- As a result of the climb, the human body becomes fatigued and thermally stressed. Many of the emergency responders indicated that they were also dehydrating and needed water to drink.

- During rest periods, the firefighters would usually take off their helmets and open their coats in order to cool off. The firefighter protective clothing is designed to be a thermal barrier during firefighting operations, and as a result it is a thermal insulator. Human body temperature rises rapidly under work conditions while clothed in insulating apparel. Many firefighters interviewed indicated that they also removed their SCBA's and coats while they were trying to cool down and rest.

Supporting First-Person Interview Comments:

- You go up about 10 flights and take a rest. You have to because you will be tired if you don't. If you run up to the 20th floor and you are tired, you can't work. You have to rest before you get up there.[263]

- Before the other building collapsed, firefighters were out of the stairway in the office area, laying on the floor, masks on the floor, and coats off or open, and resting.[264]

- We stopped every 10 floors to see the conditions. When we got up to the 20th floor we were really huffing and puffing so we broke a couple of vending machines and took the water out and started distributing it to those who were in need and then continued up.[265]

- I saw those firemen on the 27th floor. They were totally exhausted. They basically crawled onto the floor. That's why I ran and got them the water.[266]

There were several cases of firefighters suffering from chest pains or heart attacks. [267, 268] Other emergency responders were called to their aid, and at a minimum, oxygen was administered to the chest pain patients.[269] No other data were found related to these cases except that some of the emergency responders were assisted down the stairs to ambulances. FDNY interviews indicated that at least one of the chest pain cases was associated with strained chest muscles.[270]

[263] FDNY Interview 42, winter 2004.
[264] FDNY Interview 11, winter 2004.
[265] FDNY Interview 17, winter 2004.
[266] PA Interview 10, fall 2003.
[267] FDNY Interview 35, winter 2004.
[268] FDNY Interview 16, winter 2004.
[269] PA Interview 7, fall 2003.
[270] FDNY Interview 29, winter 2004.

Many additional interviewees provided information similar to that reported above. With the information gathered, NIST attempted to estimate the climbing times for the emergency responders who were interviewed. There was no accurate starting time, and there was no precise ending time for the estimates. The starting times are based on the known arrival time for a person or a unit at the WTC, an estimated time to get equipment off of an apparatus, and the estimated time it took to arrive at the Lobby Command Post and get an assignment. It is estimated that it took approximately three to five minutes for firefighters to get to the Lobby Command Post and get an assignment after arriving at the WTC. The ending times for all of the calculations for personnel inside WTC 1 are based on the floor they were on at the time when WTC 2 collapsed. Of the 26 emergency responders interviewed who were inside WTC 1, the following represents the maximum floor heights that they achieved:

- One police officer carrying no extra equipment and wearing a patrolman's uniform climbed to the 44th floor.[271]
- Seven emergency responders including personnel from FDNY and NYPD climbed to the 30's. Two of these FDNY personnel took an elevator to the 16th floor.[272]
- Sixteen emergency responders (FDNY, PAPD, and Port Authority Security) climbed to floors in the 20's.[273]
- Two emergency responders, FDNY and NYPD, climbed to the teens.[274]

Based on the data gathered, it is estimated that climbing rates varied between approximately 1.4 minutes per floor for personnel not carrying extra equipment to approximately 2.0 minutes per floor for personnel wearing firefighters' protective clothing and carrying extra equipment. These estimates have an error of approximately ±0.5 minutes per floor.

The consequence of firefighters and other emergency responders having to climb many tens of floors to get to a fire in a high-rise building can be summarized as follows:

- The climbing rate will be approximately one to two minutes per floor for emergency responders attempting to access a fire zone 30 floors or more high.
- The ability to get both personnel and needed equipment to the desired location becomes limited by building height.
- Emergency response time factors related to the rate of fire growth, the ability to rescue building occupants, and the ability to bring a fire under control becomes more critical with every additional floor in building height.

[271] PA Interview 10, fall 2003.
[272] FDNY Interviews 12, 13, 17, 25, and 39 winter 2004; NYPD Interviews 5 and 6, winter 2004.
[273] FDNY Interviews 9, 11, 16, 29, 33, 35, 37, 41, 42, 43, 52, and 56; PA Interviews 4, 6, 7, and 8, falls 2003.
[274] FDNY Interview 27, winter 2004 and NYPD Interview 22, winter 2004.

- The ability of emergency responders to climb the stairs with equipment and remain physically fit to conduct rescue and firefighting operations is diminished with every additional floor in building height that must be climbed.

5.6.6 Situational Awareness

Situational awareness is one of the overriding factors associated with understanding the operational environment, decision making, and operations command and control during periods where large amounts of information are needed and are critical to the successful outcome of a task.

Endsley defined situational awareness as follows: "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future" (Endsley 1988). In simpler terms, situational awareness refers to the degree of accuracy by which one's perception of his current environment mirrors reality (Naval Aviation Schools Command 2004). The U.S. Navy website also lists two sets of factors that affect situational awareness:

Perception versus Reality

- View of the Situation
- Incoming Information
- Expectations and Biases
- Incoming Information versus Expectations

Factors that Reduce Situational Awareness

- Insufficient Communication
- Fatigue / Stress
- Task Overload
- Task Underload
- Group Mindset
- "Press on Regardless" Philosophy
- Degraded Operating Conditions

On September 11, 2001, many emergency response personnel who conducted operations at command posts within the WTC towers indicated that they received large quantities of information related to the event, and other individuals indicated that they did not receive enough information about the situation. Both too much information and lack of information prevented responders from having adequate, accurate, and timely information for decisions that were critical to operations and may have been critical to life safety, whether it was their personal safety or the safety of others. All of the factors listed above that

reduce situational awareness, except underload, came into play during WTC operations, and as a result, many of the emergency responders struggled with their perception of what was happening compared to what was really happening.

Situational awareness was an overriding issue with all emergency responders during the WTC operations. First-person interviews with emergency responders from all agencies highlight the importance of situational awareness during this complex emergency response. Results from the interviews show that emergency responders had one of two levels of situational awareness: First, emergency responders working outside the buildings with the ability to observe site conditions as they changed felt that they had good situational awareness.[275] In addition, emergency responders who worked inside the buildings and had reliable radio communications with people outside the building felt that their situational awareness also was good. Second, emergency responders who worked inside the buildings and had no reliable means of communication other than face-to-face felt that they had poor situational awareness.[276]

Many of the emergency responders who did not see the aircraft impact into WTC 1 and reported to the scene before the second aircraft struck WTC 2 did not understand that a large commercial aircraft had struck WTC 1.[277] Many thought that a small private or commuter aircraft had hit the building. Emergency responders who could see WTC 1 and then later saw WTC 2 as they approached the towers could tell that the buildings were seriously damaged and that large fires were burning in the buildings.[278] Many thought that what had happened to WTC 1 was caused by an accident.[279] These original ideas may be related to insufficient information associated with the initial situational cues and were based on their understanding of the event as it related to past experience. However, the situation became much clearer to all that it was a terrorist attack as they either saw or received reports that a second aircraft had crashed into WTC 2.[280]

Some senior officers inside WTC 1 felt that their situational awareness was poor even though they were in radio contact with other senior officers outside the building.[281] One of these senior officers stated that *he would have known more about what was going on during the incident if he had been home watching it on TV.*[282] It took time to confirm that a second aircraft had actually hit WTC 2. A large number of emergency responders who were working inside WTC 1 realized that something had happened but did not know what had occurred when the second aircraft struck WTC 2.[283] Some firefighters who were going up in the stairways inside WTC 1 did not know that anything had happened when the second aircraft struck WTC 2.[284]

[275] FDNY Interviews 1 – 68, fall 2003 and winter 2004.
[276] FDNY Interviews 1 – 68, fall 2003 and winter 2004.
[277] FDNY Interview 1, fall 2003 and FDNY Interview 4, winter 2004.
[278] FDNY Interview 4, winter 2004.
[279] FDNY Interview 4, winter 2004.
[280] FDNY Interviews 12, 21, and 29, winter 2004 and NYPD Interview 6, winter 2004.
[281] FDNY Interview 20, winter 2004.
[282] FDNY Interview 7, winter 2004.
[283] FDNY Interviews 11 and 12, winter 2004.
[284] FDNY Interview 42, winter 2004.

The situation was somewhat different when WTC 2 collapsed. Many emergency responders inside WTC 1 felt the building shake violently and thought that another aircraft had flown into WTC 1 or that a portion of WTC 1 had collapsed above them.[285] All emergency responders interviewed knew that something significant had occurred, but they didn't know exactly what had happened. This lack of situational awareness clearly had a negative impact on some emergency responders who did not understand what had happened when WTC 2 collapsed. It may have been responsible to some degree for the slow evacuation pace that some emergency responders observed after the responders themselves were ordered to evacuate from WTC 1. The following quote describes situational awareness for a small group of firefighters inside WTC 1 shortly after WTC 2 collapsed:

> "We were trapped in the interior space, deaf and blind to the rest of the world, to the devastation outside our windows – probably the only group of people in the civilized world who hadn't seen what had happened to the south tower. We might as well have been in a cave, for all we could tell about what was unfolding on the plaza below."(Picciotto 2002)

The following statements concerning situational awareness were extracted from FDNY and PAPD first-person interview notes:

- We are in the forest here and we are talking about various trees in the forest; we are really just talking about communications. Everybody, my wife and the people in California knew more about the situation than me. It was ridiculous. I didn't know what was going on out there.[286]

- In between the 21st and 22nd there were some firefighters coming down who said they were told to evacuate. At that time, we still did not know the other tower had collapsed.[287]

Situational awareness is influenced by the amount and quality of information available (Endsley 1988). The following statement provides information concerning communications capabilities related to the ability to share critical information inside WTC 1:

- It was found that FDNY didn't have effective radio communications with the floors above the lobby. Mostly, their handie-talkie radio communications were ineffective. The interviewee instructed one of his associate Chiefs to activate the building repeater. The repeater didn't seem to work and they thought that the airplane impact destroyed the repeater system. In order to establish some type of communications in the building they tried the standpipe phones and they tried intercom systems. Nothing worked.[288]

Many of the emergency responders who narrowly escaped the collapse of WTC 1 never understood that WTC 2 and WTC 1 had fully collapsed until the dust and smoke began to clear almost an hour after

[285] FDNY Interview 25, winter 2004.
[286] FDNY Interview 11, winter 2004.
[287] FDNY Interview 16, winter 2004.
[288] FDNY Interview 20, winter 2004.

WTC 1 had collapsed.[289] Some responders indicated that they did not understand the magnitude of what happened that morning at the WTC until the next day.[290]

5.7 INFORMATION, COMMUNICATIONS, AND RESPONDER EVACUATION FROM THE WORLD TRADE CENTER

Information coming into several of the New York City emergency response communications centers indicated that building conditions for the two WTC towers were steadily degrading. At approximately 9:36 a.m., a New York City 9-1-1 telephone operator received a call from inside of WTC 2 stating that a floor had collapsed somewhere in the 90s.[291] This information was then transferred to a NYPD dispatcher who communicated at about 9:51 a.m. that the 106th floor inside WTC 2 was crumbling. According to a NYPD document, this report appears to have misidentified the floor that had collapsed.[292] However, this information concerning the floor collapse was still important as it related to the seriousness of the degrading conditions. Just prior to this message, at approximately 9:49 a.m., one of the NYPD helicopter units reported over the Special Operations Division radio channel that "large pieces" were falling from WTC 2. Each of these messages suggested that the top floors of WTC 2 were experiencing significant degradation; however, none of the emergency responders interviewed believed that there would be total collapse of the building. Also, emergency responders reported during their interviews that around the same time period that these radio messages were being collected and distributed, a runner was sent from OEM to the FDNY Incident Command Post (ICP) to inform them that an engineer believed the WTC towers were nearing conditions that would cause a collapse.[293] The runner got to the FDNY Incident Command Post located in the front of World Financial Center 2 just before WTC 2 collapsed and was in the process of delivering the message when WTC 2 collapsed.[294] Figure 5–13 shows the FDNY ICP located in the garage driveway of WFC 2.

With the collapse of WTC 2, each emergency responder department sent out radio messages calling for the immediate evacuation of WTC 1.[295, 296] At least three FDNY Chief Officers at ground level transmitted urgent radio messages over their handie-talkie radios calling for the evacuation of WTC 1 following the collapse of WTC 2.[297, 298] Additionally, one FDNY Chief Officer located upstairs inside WTC 1 called over his radio for emergency responders to evacuate the building.[299] Interview data from emergency responders who were located upstairs inside WTC 1 provide some insight into how orders to

[289] FDNY Interview 10, winter 2004.
[290] FDNY Interview 5, winter 2004.
[291] McKinsey & Company, NYPD call-routing and message dispatch, "106th floor is collapsing," draft summary report July 23, 2002.
[292] McKinsey & Company, NYPD call-routing and message dispatch, "106th floor is collapsing," draft summary report July 23, 2002.
[293] FDNY Interview 46, winter 2004.
[294] FDNY Interview 46, winter 2004.
[295] NYPD Interview 24, spring 2004.
[296] PA Interview 10, fall 2003.
[297] FDNY Interview 7, winter 2004.
[298] FDNY Interview 20, winter 2004.
[299] FDNY Interview 25, winter 2004.

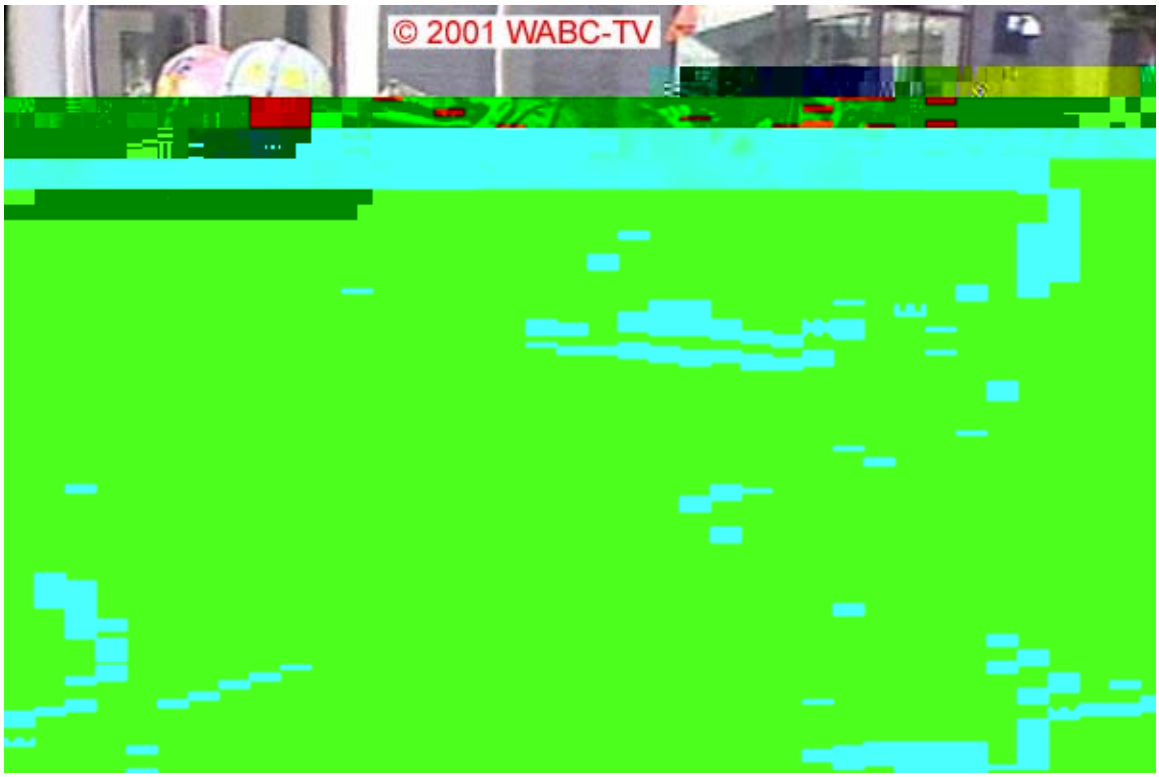

Figure 5–13. Video image of the FDNY Incident Command Post in front of World Financial Center 2.

evacuate the building were received following the collapse of WTC 2. Several firefighters and FDNY officers heard the evacuation orders on their radios while others did not hear the orders. (Table 5–1) One firefighter received the information to evacuate from a FBI employee[300], and the remaining firefighters received their evacuation information from other FDNY personnel.[301]

NYPD ESU personnel inside of WTC 1 received their orders to evacuate from an ESU Mobilization Point staff person located at Church and Vesey Streets.[302] These radio communications came over a point-to-point radio channel that was being used to communicate with the ESU teams inside the buildings.

PAPD command personnel also called for the evacuation of WTC 1. One PAPD Police Officer heard the order to evacuate over his handie-talkie radio.[303] One of the PAPD Police Officers was told to evacuate by a FDNY Company Officer.[304] Another PAPD Police Officer was told to evacuate by a FDNY firefighter, and one was told to evacuate by another PAPD Police Officer.[305]

[300] FDNY Interview 12, winter 2004.
[301] FDNY Interviews 11, 12, 13, 16, 33, 35, 41, 43, and 52, winter 2004.
[302] NYPD Interview 5, winter 2004.
[303] PA Interview 6, fall 2003.
[304] PA Interview 8, fall 2003.
[305] PA Interview 7, fall 2003.

Table 5–1 summarizes information gathered concerning how evacuation messages were distributed to the surviving WTC 1 emergency responders who were interviewed. In the table a floor height is given for each emergency responder indicating what floor they were on when they received the message to evacuate WTC 1. The emergency responders were located at various places inside the building. They may have been inside any of the three stairways or out on the building's floors when the evacuation message was received.

As demonstrated in Table 5–1, radio communications associated with the order to evacuate WTC 1 had mixed results. The data shows that different personnel located on the same floors of the building either heard the evacuation orders or did not hear the orders over the radio. This failure to receive the evacuation messages may be attributed to a number of factors, including:

- the person's location inside the building and their relative position to building materials or structures that attenuated radio signals,
- the operational condition of their radio,
- their radio volume may have been turned down,
- they or someone nearby was transmitting on the same radio channel at the time when evacuation orders were given, and/or
- noise levels around the person, etc.

Also, the interview information gathered demonstrates that individuals who had the evacuation information actively told others that the building was being evacuated.

After receiving the order to evacuate, some FDNY personnel indicated that there were people in the building who needed medical attention and assistance in evacuating. Several FDNY personnel told the survivors that were interviewed by NIST that they were going to stay behind to help the people who needed them.[306] The following interview statements made by FDNY firefighters relate to personnel staying behind:

> ▪ One firefighter got the order to evacuate, but he refused because he was helping injured people. He was in the WTC 1 Sky Lobby, on the 44th floor. Another firefighter the interviewee saw was standing in a doorway. The interviewee told him "Let's go, we have to evacuate." The firefighter told him okay, but he was waiting for his chief. The interviewee said that these guys were much like him and the others that were evacuating while helping a lady out of the building. It was the nature of the beast. A firefighter could not just walk out and leave these people who needed help. Other firefighters

[306] FDNY Interview 56, winter 2004.

wanted to be sure that their company members were accounted for and also out safe, and they didn't want to leave without them.[307]

- The interviewee was evacuating down the stairway inside WTC 1 and came across two PAPD officers. They were heading up the stairs. He told them that they had to evacuate, but they said that they had to get to the other Port Authority officers in the building.[308]

- After realizing that WTC 2 had collapsed we started our evacuation. We then heard the order on the radio to evacuate. From the 27th floor, as we were going down the stairs, I could hear radio reports from a Captain who was around the 40th floor. One FDNY Captain reported on the radio that there were too many burned people with him and that he was not going to leave them.[309]

Table 5–1. WTC 1 evacuation data from emergency responder interviews.

	FDNY[a]	NYPD[b] ESU	PAPD[c]
Personnel interviewed that went up stairways inside WTC 1	18	3	5
Personnel with handie-talkie radios	15	3	3
Personnel with handie-talkies radios that **heard the evacuation order for WTC 1 on their radio**	8	3	2
Floors responders were on when message was received to evacuate WTC 1	19, 22, 23, 27, 27, 31, 35, 36	11, 31, 31	22, 35
Personnel with handie-talkie radios who **did not hear the evacuation order for WTC 1 on their radio**, but were told to evacuate by other personnel	7	0	1
Floors responders were on when message was received to evacuate WTC 1	21, 23, 27, 27[d], 28, 34, 25	n/a	24
Personnel without handie-talkie radios	3	0	2
Personnel **without handie-talkies radios that heard the evacuation order for WTC 1 over someone else's s radio**	1	0	0
Floor responder was on when he heard the order to evacuate WTC 1.	23	n/a	n/a
Personnel **without handie-talkie radios that were told to evacuate by other personnel**	2	0	2
Floors that responders were on when told to evacuate WTC 1	22, 31	n/a	24, 25

a. FDNY Interviews # 9, 11, 12, 13, 16, 17, 25, 27, 29, 33, 35, 37, 39, 41, 42, 43, 52, and 56
b. NYPD Interviews # 5, 6, and 22
c. PAPD/PA Security Interviews # 4, 6, 7, 8, and 10
d. This emergency responder had made an independent decision to leave WTC 1 before the collapse of WTC 2 because one of his members was experiencing medical problems. The responder received a verbal evacuation order as they were in the process of evacuating the building.

[307] FDNY Interview 56, winter 2004.
[308] FDNY Interview 25, winter 2004.
[309] FDNY Interview 56, winter 2004.

Many of the emergency responders who were interviewed indicated that as they came down the stairs they stopped on each floor to check for occupants or called out that everyone should leave the building.[310] The emergency responders also reported that there were still a few civilians still going down the stairs as they went down the staircases.[311] Several of the civilians were building occupants who were mobility impaired and needed assistance.[312] Emergency responders provided assistance to these individuals as needed.[313] As the responders went down through the building, they found approximately 40 to 60 mobility impaired people sitting inside offices on the 12th floor. [314] These individuals had been placed on the floor in order to clear the staircases since they had been causing the evacuation to slow. The emergency responders got approximately 20 of these people up and began assisting them down the stairs as they were attempting to evacuate the building.[315] Other firefighters stayed behind to assist others who needed help.[316] WTC 1 collapsed as firefighters and police officers were getting this first group of mobility impaired people outside.[317] It is not known how many mobility impaired building occupants or emergency responders died during this part of the operation. Additionally, a building occupant who was able to exit WTC 1 just in time to save his life reported that as he went through the lobby, "there were firefighters who did not leave the building, they were milling around the fire desk in the lobby."[318] (NIST 2004)

5.8 EFFECT OF WTC 2 COLLAPSE ON EMERGENCY OPERATIONS

With the collapse of WTC 2, all emergency responder operations at the WTC were disrupted. This included operations being carried out by FDNY, NYPD, PAPD, PANYNJ, and OEM. When WTC 2 collapsed, it resulted in fatalities and injury of many emergency responders at the scene. Also, all operations at emergency responder command posts and mobilizations points at and near the WTC complex were disrupted. Falling debris destroyed command posts and critical equipment being used by emergency responders during the ongoing operations.[319] The wind and dust cloud generated during the collapse also hampered operations. Emergency responders reported being blown into the air and tumbling down the street as WTC 2 collapsed.[320] Some police officers reported that the wind was so strong that it ripped equipment from their gun belts and blew it away.[321] With these high winds, some emergency responders felt intense heat as the wind blew past them, and they were hit by flying debris.[322] All of the emergency responders interviewed who were near street level when WTC 2 collapsed reported

[310] FDNY Interview 25, winter 2004.
[311] FDNY Interviews 11, 13, and 16, winter 2004.
[312] PA Interviews 8 and 10, fall 2003.
[313] FDNY Interview 25, winter 2004.
[314] FDNY Interview 25, winter 2004.
[315] NYPD Interview 22, spring 2004 and PA Interviews 7 and 8, fall 2003.
[316] FDNY Interview 25, winter 2004.
[317] FDNY Interview 25, winter 2004.
[318] Building Occupant Interview 1000118.
[319] FDNY Interviews 20, 51, and 65, winter and spring 2004.
[320] NYPD Interviews 8 and 16, winter 2004 and FDNY Interview 67, spring 2004.
[321] PA Interview 9, fall 2003.
[322] FDNY Interviews 64 and 65, spring 2004.

that the dust cloud and smoke was so thick and black that they could not see anything or breathe. The dust in the air was so thick that it filled their eyes and mouths.[323]

Immediately following the collapse, emergency responders reported that there was a period where they heard no radio communications.[324] They did not know whether it was caused by the thick dust cloud preventing radio signals from getting through or if no one was able to communicate on the radio. As the dust and smoke began to clear, many of the emergency responders found that their radio microphones and speakers were filled with dust and debris.[325] Also, police officers' firearms were clogged with dust and debris.[326] The emergency responders generally indicated that they immediately attempted to clear their critical equipment to get it working again.[327] As the radio systems came back on line, emergency responders indicated that the radios became filled with Mayday distress messages, and surviving personnel began to respond to these calls for help.[328]

As the dust and smoke continued to clear, emergency responders also began to assess their operational situation. The FDNY Incident Command Post located in front of World Financial Center 2 (WFC 2) on West Street was destroyed and many of its personnel were missing. The FDNY Field Com unit that was located at the Incident Command Post also was lost, and the personnel operating the system evacuated toward the Hudson River.[329] Therefore, all FDNY command communications at the site were lost except those that could be carried out using the low output power handie-talkie radios carried by the command officers. It soon became apparent that WTC 2 had fully collapsed, and that the Lobby Command Post there was destroyed, and the FDNY personnel operating the command post were missing. The FDNY Command Post located on the corner of Liberty Street and West Street was destroyed, and personnel were missing, and the Lobby Command Post inside of WTC 1 had been abandoned as personnel evacuated in an attempt to save their lives.[330] When WTC 2 collapsed, it fell into the Marriott Hotel killing, injuring, and trapping many firefighters inside the damaged structure. This also ended the Command Post operations inside the hotel.[331] The primary NYPD mobilization point located at Church Street and Vesey was abandoned as WTC 2 collapsed, and operations at the NYPD mobilization point on West Street and Vesey Street were ended.[332] The PAPD police desk inside WTC 5 also was abandoned following the collapse of WTC 2.[333] Although the OEM command center inside WTC 7 had already been evacuated, OEM personnel working around the site and stationed with the Mayor also had to evacuate from the WTC site, which had a negative impact on effective operations at the highest command level.[334] Loss of the various critical personnel and the emergency responder command posts seriously disrupted emergency operations at the WTC. In addition, all records associated with emergency responder personnel

[323] FDNY Interview 64, spring 2004.
[324] FDNY Interview 22, winter 2004.
[325] FDNY Interview 45, winter 2004.
[326] PA Interview 9, fall 2003.
[327] PA Interview 9, fall 2003.
[328] FDNY Interviews 30 and 31, winter 2004.
[329] FDNY Interviews 58 and 61, winter 2004 and spring 2004.
[330] FDNY Interviews 2 and 7, fall 2003 and winter 2004.
[331] FDNY Interview 62, spring 2004.
[332] NYPD Interview 24, spring 2004.
[333] PA Interview 3, fall 2003.
[334] NYPD Interview 2, winter 2004 and FDNY Interview 46, winter 2004.

accountability and operations were lost, and vital equipment for carrying out the emergency operations was destroyed by debris and fire.

5.8.1 Emergency Responder Apparatus at the WTC

During emergency operations, it is important that a fire department assigns and dispatches the appropriate types and numbers of apparatus and personnel needed to accomplish the mission. As fire department personnel arrived at the WTC scene, they positioned their apparatus in a fashion that would allow them to quickly access their equipment and bring it into use to control the fire and protect lives.[335] Firefighters knew that they would have to be at the WTC for many hours and that they would need a significant amount of equipment to conduct operations inside the WTC towers.[336] Figure 5–14 and Figure 5–15 show the locations of parked emergency vehicles at the WTC before the towers collapsed.

Figure 5–14. Photograph taken from near the corners of West and Vesey Streets looking south before the collapse of WTC 2.

[335] FDNY Interviews 16, 32, 39, and 44, winter 2004.
[336] FDNY Interviews 18 and 30, winter 2004.

Figure 5–15. Photograph taken from West Street looking towards (right to left) Liberty Street, WTC 2, and the Marriott Hotel before the collapse of WTC 2.

Firefighters had never experienced the total collapse of a tall high-rise building and did not believe that the towers would fully collapse during their operations.[337] Therefore, many FDNY vehicles and other emergency apparatus were parked within the collapse zone of the towers. The total number of emergency response apparatus near the WTC towers ranges from approximately 100 to 170 vehicles.[338] As a result of the collapse, 91 FDNY vehicles and apparatus were destroyed when the buildings collapsed.[339] Table 5–2 contains a list of vehicles destroyed:

Each of the vehicles and firefighting apparatus listed in Table 5–2 carried equipment vital for conducting firefighting and rescue operations. The loss of the 343 firefighters coupled with the loss of the valuable equipment listed above created a significant reduction in FDNY's capabilities. This loss of human life and the capital assets makes it imperative that emergency operations protocols for tall buildings be critically reassessed. Figures 5–16, 5–17, and 5–18 show some of the emergency response apparatus destroyed during the collapse of the WTC towers.

[337] FDNY Interviews 1, 2, 6, 7, 11 – 15, 17, 19, and 20, fall 2003 and winter 2004.
[338] FDNY, Vehicles Missing or Destroyed at WTC Disaster, 2002.
[339] FDNY, Vehicles Missing or Destroyed at WTC Disaster, 2002.

Table 5–2. FDNY vehicles and apparatus destroyed by collapse of WTC towers.

Vehicles or Apparatus Destroyed	Number Destroyed
Ambulances	5
Ladders or Trucks	15
Engines or Pumpers	18
Satellite Pumper	1
Rescue Vehicle, Primary	2
Rescue Vehicle, Secondary	1
Squad Vehicle, Secondary	3
High-Rise Vehicle	2
Emergency Crew Vehicle	2
Field Comm (Spare)	1
Mask Service Unit	1
Tac (Tactical Equipment Unit)	1
Sedans	23
Staff Utility Vehicles	16
Total	91

Figure 5–16. Destroyed fire apparatus following the collapse of WTC 1 and 2.

Figure 5–17. Damaged emergency apparatus at the corners of West and Vesey Street after the collapse WTC 1 and 2.

Figure 5–18. Burned out fire apparatus on West Broadway next to WTC 7 following the collapse of WTC 1 and 2.

5.8.2 Emergency Responder Equipment

Generally, before the towers collapsed equipment used by emergency responders at the WTC was adequate for the operations being carried out.[340] However, there are some points related to equipment that need consideration.

Thousands of pounds of emergency equipment are typically needed for operations where people are seriously injured, buildings are damaged with the possibility of structural collapse, and large fires are burning. All of these conditions existed at the WTC on September 11, 2001. As a result of the elevators being unsafe or inoperable, emergency responders hand carried almost all equipment needed with them up the stairs. This emergency equipment included rescue equipment, medical equipment, and some firefighting equipment. The equipment locker on the 44th floor of WTC 1 that was opened by a Port Authority employee did not have the equipment necessary for conducting large scale operations that were required in the building.[341] Also, tenants on the upper floors of WTC 1 who attempted to provide medical aid to the injured and rescue people trapped in elevators indicated that they did not have the equipment needed to carryout those tasks.[342] Additionally, protective clothing systems produced heat stress and added to the firefighters' fatigue as they climbed the stairs.[343] From these observations, it is apparent that the issue of pre-positioned equipment is vitally important for emergency response in high-rise buildings, and there should be a means for the emergency responder agencies and high-rise building owners to ensure that the pre-positioned equipment is adequately inspected, maintained, and certified for use.

The emergency responder first-person interviews highlighted three pieces of equipment that made a difference in their operations that day; in fact, they are credited with saving the lives of many emergency responders. These items were: radios, flashlights, and SCBA's (Self Contained Breathing Apparatus) carried by the emergency responders.

Radios

Although significant problems were reported with the use of handie-talkie radios at the WTC site, many emergency responder personnel, from each of the emergency response organizations, reported that their radios played a part in saving their lives. Some statements extracted from first-person interviews related to hearing the calls for evacuating WTC 1 follow:

- Later on my handie-talkie I heard an order to evacuate. Then there was a lot of handie-talkie communications. I believe there was a PAPD officer with an air-pack, and he had a radio and he told us there was an order to evacuate the building, WTC 1.[344]

[340] FDNY Interview 37, winter 2004 and NYPD Interview 19, spring 2004.
[341] PA Interview 10, fall 2003.
[342] Building Occupant Interview 1000118.
[343] FDNY Interviews 17, 28, and 33, winter 2004.
[344] FDNY Interview 39, winter 2004.

- When I got to the 22nd floor there was a lot of debris, everything was pushed to the center of the building. The windows were knocked out and I could feel the wind. I could not see. I got a radio transmission that said everyone in Tower 1, get out.[345]

- Firehouse 10 located across the street from the WTC gave us the information that we needed. Lucky for us, those items were all relevant to Tower 1. House 10 was monitoring Tower 1 radio transmissions.[346]

- I heard my boss calling for help on the radio. He was trapped and calling for help. I knew that I had to go find him so I started talking to him on the radio. He was found by another fireman buried in rubble and he was rescued.[347]

- I heard a muffled message on my radio that there was a mayday, get out of the building. The south tower has come down…. I had an older radio; I didn't have the new radio that they were phasing in. I had the old antique MX 330, it was twice the size of a normal radio, but it picked up everything.[348]

Flashlights

During the response on September 11, 2001, emergency responders found that flashlights were an extremely important piece of equipment. In the darkness, smoke, and debris throughout the WTC complex, flashlights enabled emergency responders to find other emergency responders, occupants, and identify hazards. [349] Emergency responders used flashlights to find and navigate routes of evacuation for themselves and others. [350] In addition, flashlights provided a source of hope and comfort in the darkness. Emergency responders and others gathered around those who had flashlights as they evaluated their situation and developed evacuation strategies. There were cases where as many as 25 to 30 people would gather around a single flashlight in the darkness.[351] Numerous emergency responders credited flashlights with saving their lives.

The following statements concerning flashlights were extracted from the emergency responder first-person interview notes:

- I was in the super heated gases in the epicenter, which was sort of hellish. A fellow responder took his flashlight and pointed me in a direction. I hobbled and crawled. I finally hit WFC 2.[352]

[345] FDNY Interview 42, winter 2004.
[346] FDNY Interview 47, winter 2004.
[347] FDNY Interview 54, winter 2004.
[348] FDNY Interview 9, winter 2004.
[349] FDNY Interview 45, winter 2004.
[350] FDNY Interview 32, winter 2004.
[351] NYPD Interview 19, spring 2004.
[352] FDNY Interview 12, winter 2004.

- I told everyone, don't move, and stay where you are. I didn't want to cause a secondary collapse. Just look, we were able to find flashlights… I said, just look around you, and see if you can see a way out.[353]

- It was dark in the stairwell. If I didn't have a flashlight, I'd be on night vision. It was dark. Plus, with the smoke and soot and there's no windows. I think the emergency light was working, but it wasn't very bright.[354]

- The interviewee began to hear the beeping and chirping of the firefighters pass devices. The interviewee didn't have a flashlight and it was pitch black inside the building, but someone did have their flashlight and turned it on. He could see the light and he then knew that he was not blind. That gave him hope. They had light. Others gathered around the light. Soon there was a large group of people only a few around the light could see…. Others got close and made physical contact in the darkness. The little flashlight helped. The people in the front of the line with the light could see where they were going. The people at the other end of the line away from the light could not see and held on following the lead of the rest.[355]

- The firefighter chopped a hole through the wall. The police and the Port Authority personnel went through the same hole to exit. He was using his flashlight to help people walking through the hole to see.[356]

- He also gave the medical oxygen bottle to a firefighter that needed help. His flashlight saved his life by lighting his way out.[357]

- People were in sneakers and they had flashlights and masks and the only thing I could assume right there is that these people knew what they were doing because of 1993. I'm quite sure that they had some kind of fire drills because of the bombing in 1993.[358]

These comments from emergency responders point out the importance of having a reliable flashlight during a serious incident. The comments are only a small sample of statements made by emergency responders concerning their flashlights and how they played an important roll in life saving that day. When considering the issue of flashlight usage, it should not be forgotten that on September 11, 2001, it was a clear, blue sky day with no clouds. By the time WTC 2 collapsed, the sun had risen to a relatively high angle in the sky, and the WTC site was well illuminated. However, with the collapse of WTC 2, this pristine day suddenly became so black that people literally could not see their hands in front of their

[353] FDNY Interview 25, winter 2004.
[354] FDNY Interview 29, winter 2004.
[355] NYPD Interview 3, winter 2004.
[356] PA Interview 2, fall 2003.
[357] PA Interview 6, fall 2003.
[358] PA Interview 9, fall 2003.

faces, even outside of the buildings in the open space of the streets. [359] Inside the buildings, emergency responders not only had to deal with dust and smoke, but also were located in areas where the loss of electrical power made the area pitch black. This condition was described particularly by people who were trapped in the Concourse level of the WTC and people in the lower floors of the WTC 1 staircases.

Breathing Apparatus (SCBA)

The third piece of equipment reported as being extremely valuable by emergency responders was the air-pack or SCBA. Numerous emergency responders indicated that they used their SCBAs to breathe after the WTC towers fell. The air was thick with debris, dust, and smoke and most people found it difficult to breathe.[360] Personnel with SCBAs were able to place the mask over their faces and breathe fresh air from the air bottle even through the outside air was thick with dust and smoke. Many of the emergency responders with SCBAs shared their air supply with others around them. The following is a sample of statements made by emergency responders during first-person interviews related to the use of their SCBA's:

- One of the men near him had a SCBA air-pack and they were able to buddy breathe as they made their way out of the building.[361]
- One of then had an air-pack. They were all vomiting; breathing was difficult. They shared the air-pack so that they could breathe fresh air. They were able to exit the building in about ten minutes and ended up on South End Avenue.[362]
- My air-pack was great; it saved my life and I am glad I was trained with it.[363]
- My air-pack and my flashlight saved my life.[364]
- If we didn't have our air-packs, we wouldn't have made it.[365]

5.9 EMERGENCY RESPONSE OPERATIONS AT WORLD TRADE CENTER 7

World Trade Center 7 (WTC 7) was an important building with regard to the attack on the World Trade Center. The New York City Office of Emergency Management (OEM) was located on the 3rd and 23rd floors of WTC 7.[366] The OEM office on the 23rd floor contained the emergency operations post for OEM and was designed to function as a command center to help coordinate multi-agency operations at

[359] FDNY Interview 12, winter 2004.
[360] FDNY Interview 67, spring 2004.
[361] FDNY Interview 67, spring 2004.
[362] FDNY Interview 64, spring 2004.
[363] NYPD Interview 8, winter 2004.
[364] NYPD Interview 19, winter 2004.
[365] PA Interview 8, fall 2003.
[366] FDNY Interview 54, winter 2004.

incidents in the city.[367] (Sheirer 2004) On September 11, 2001, WTC 7 became threatened as the WTC complex was attacked.

When the first aircraft struck WTC 1, the electrical power went out for several seconds inside WTC 7.[368] Many people immediately began leaving the building, and the OEM operations center began receiving calls related to the emergency.[369] As the second aircraft struck WTC 2, a decision was made to evacuate WTC 7.[370] By the time WTC 2 was struck by the second aircraft at 9:03 a.m., many WTC 7 occupants had already left the building and others had begun a self-evacuation of the building. Shortly after WTC 2 was struck, a firefighter entered WTC 7 from the Washington and Vesey Streets side, connected a hose line onto the "A" stairwell sprinkler riser and started the Engines pumps.[371] At approximately 9:30 a.m., FDNY, EMS established a Division for assisting victims at WTC 7.[372] An EMS triage center was established in the lobby of WTC 7 as occupants from WTC 1 and WTC 6 evacuated through WTC 7.[373] At approximately 9:44 a.m., after the report of a third aircraft heading into the city and news that the Pentagon had been attacked, a Deputy OEM Commissioner ordered the complete evacuation of WTC 7. (Sheirer 2004) This order included the evacuation of the OEM operations center on the 23rd floor. The loss of the OEM operations center created difficulties related to the coordination of emergency responder operations and resources.[374] Before the OEM operations center was evacuated, OEM had assigned personnel to work with each of the emergency responder command posts. This reduced the impact of the loss of the WTC 7 OEM office. (See Chapter 8.) Occupants evacuating from WTC 7 used both the elevators and stairways as they left the building.[375] Shortly after WTC 7 was evacuated, the FDNY Fire Commissioner arrived, looking for the Mayor who he believed to be at the OEM center on the 23rd floor. A guard met the Commissioner in the lobby and ordered him and his staff out of the building. The guard told him, "This building has been evacuated." and that "OEM, the mayor, they're all gone." (Von Essen 2002)

At 9:59 a.m., WTC 2 collapsed, and debris from the collapse struck the south face of WTC 7.[376] At 10:28 a.m., WTC 1 collapsed and a significant amount of damage was done to WTC 7.[377] A large amount of debris crashed through the front center of the building from approximately the 10th floor down to ground level, and debris ripped a part of the southwest corner off from approximately the 8th floor up to the 18th floor.[378] The collapse of WTC 1 also appears to be responsible for starting fires inside of WTC 7.[379] With the collapse of the two towers, a New York City employee and a WTC 7 building staff person became trapped inside of WTC 7.[380] The two had gone to the OEM center on the 23rd floor and

[367] FDNY Interview 54, winter 2004.
[368] FDNY Interview 54, winter 2004.
[369] FDNY Interview 54, winter 2004.
[370] WTC 7 Interview 1110402, fall 2002.
[371] WTC 7 Interview 2110402, fall 2002.
[372] McKinsey & Company, *Increasing FDNY's Preparedness*, New York, August 2002.
[373] FDNY Interview 45, winter 2004.
[374] FDNY Interview 45, winter 2004.
[375] WTC7 Interviews 1110402 and 2110402, fall 2002.
[376] FDNY Interview 45, winter 2004.
[377] PAPD Interview 1, fall 2003.
[378] FDNY Interview 3, winter 2004.
[379] FDNY Interview 19, winter 2004.
[380] WTC 7 Interviews 2041604 and 1041704, spring 2004.

found no one there. As they went to get into an elevator to go downstairs the lights inside of WTC 7 flickered as WTC 2 collapsed. At this point, the elevator they were attempting to catch no longer worked, so they started down the staircase. When they got to the 6th floor, WTC 1 collapsed, the lights went out in the staircase, the sprinklers came on briefly, and the staircase filled with smoke and debris. The two men went back to the 8th floor broke out a window and called for help. Firefighters on the ground saw them and went up the stairs. In addition, a security officer for one of the businesses in the building was also was trapped on the 7th floor by the smoke in the stairway. As the firefighters went up, they vented the stairway and cleared some of the smoke. They first met the security officer on the 7th floor and firefighters escorted him down the stairs. Other firefighters from the group continued up the stairs, shined their flashlight through the staircase smoke and called out. The two trapped men on the 8th floor saw the flashlight beam and heard the firefighters calling and went down the stairway. The firefighters took the men outside and directed them away from the building.[381]

At approximately 11:30 a.m., FDNY assigned a Chief Officer to take charge of operations at WTC 7. The Chief was initially given orders to put the fires out in WTC 7.[382] From the Chief's assigned location at WTC 7, he reported that looking south toward WTC 7, they could not see the building because of the large smoke and dust cloud. The Chief Officer was able to negotiate the debris fields, get to the building, and see the WTC 7 logo on the side. There were numerous burned out FDNY vehicles around WTC 7. At the corner of Vesey and West Broadway, a FDNY Engine was connected to a hydrant at the corner of WTC 7. Hose lines were stretched, and the Engine's pump was still running even though the Engine was on fire and was almost burned out. There was no water coming out of the hydrant system.[383] One FDNY Chief Officer that entered WTC 7 indicated that he opened a standpipe on the 4th floor of one stairway and found no water in the standpipe system.[384] A FDNY fire boat and the retired FDNY fire boat "Harvey" were located at the shore on the Hudson River near the site. They were starting to stretch lines up to the WTC.[385] According to the FDNY first-person interviews, water was never an issue at WTC 7 since firefighting was never started in the building.[386] When the Chief Officer in charge of WTC 7 got to Barclay Street and West Broadway, numerous firefighters and officers were coming out of WTC 7. These firefighters indicated that several blocks needed to be cleared around WTC 7 because they thought that the building was going to collapse.[387]

Con Edison personnel arrived at the scene and consulted with FDNY. They wanted to know if they should cut the power off at the WTC 7 power station. It was decided to leave the power on and not allow Con Edison personnel to enter WTC 7 because it was not safe.[388] The Con Edison personnel also indicated that fuel tanks were located in the lower level of WTC 7. However, they could not determine if the fuel tanks were involved with the fires burning in the building. FDNY personnel reported that they did not see any indication of burning liquid fuels before the building collapsed.[389] No accurate time is

[381] WTC 7 Interviews 2041604 and 1041704, spring 2004.
[382] FDNY Interview 3, winter 2004.
[383] FDNY Interview 3, winter 2004.
[384] FDNY Interview 3, winter 2004.
[385] FDNY Interview 3, winter 2004.
[386] FDNY Interview 3, winter 2003.
[387] FDNY Interview 3, winter 2004.
[388] FDNY Interview 3, winter 2004.
[389] FDNY Interview 3, winter 2004.

available for this event during the operations; however, the sequence of events indicates that it occurred between approximately 12:00 noon and 2:00 p.m.

One Battalion Chief coming from the building indicated that they had searched floors 1 through 9 and found that the building was clear.[390] In the process of the search, the Battalion Chief met the building's Fire Safety Director and former Deputy Fire Safety Director on the ninth floor. The Fire Safety Director reported that the building's floors had been cleared from the top down. By this time, the Chief Officer responsible for WTC 7 reassessed the building again and determined that fires were burning on the following floors: 6, 7, 8, 17, 21, and 30.[391] No accurate time is available for these actions during the WTC 7 operations; however, the sequence of event indicates that it occurred during a time period from 12:30 p.m. to approximately 2:00 p.m.

The Chief Officer then met with his command officer to discuss the building's condition and FDNY's capabilities for controlling the building fires. A Deputy Chief who had just returned from inside the building reported that he had conducted an inspection up to the 7th or 8th floor.[392] He indicated that the stairway was filling with smoke and that there was a lot of fire inside the building. The chiefs discussed the situation and the following conditions were identified: [393, 394]

- The building had sustained damage from debris falling into the building, and they were not sure about the structural stability of the building.
- The building had large fires burning on at least six floors. Any one of these six fires would have been considered a large incident during normal FDNY operations.
- There was no water immediately available for fighting the fires.
- They didn't have equipment, hose, standpipe kits, tools, and enough handie talkies for conducting operations inside the building.

At approximately, 2:30 p.m., FDNY officers decided to completely abandon WTC 7, and the final order was given to evacuate the site around the building. [395, 396] The order terminated the ongoing rescue operations at WTC 6 and on the rubble pile of WTC 1. Firefighters and other emergency responders were withdrawn from the WTC 7 area, and the building continued to burn. At approximately 5:20 p.m., some three hours after WTC 7 was abandoned the building experienced a catastrophic failure and collapsed.

[390] FDNY Interview 26, winter 2004.
[391] FDNY Interview 3, winter 2004.
[392] FDNY interview 14, winter 2004.
[393] FDNY Interview 3, winter 2004.
[394] FDNY Interview 14, winter 2004.
[395] FDNY Interview 3, winter 2004.
[396] FDNY interview 14, winter 2004.

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Chapter 6
PLANNING FOR MAJOR OPERATIONS IN TALL BUILDINGS

6.1 FIRE AND EMERGENCY RESPONSE PROTOCOLS FOR TALL BUILDINGS

On September 11, 2001, FDNY was conducting high-rise firefighting procedures based on their document, FDNY DCN: 3.02.01, Fire Fighting Procedures High-Rise Office Buildings, Volume 1, Book 5, January 1, 1997.[1] A complete copy of this document is located in Appendix I. The purpose of this documents as stated in the introduction is:

- To describe High-Rise Class "E" office buildings. Over 800 of these structures can be found in New York City.
- To point out the problems and features of such buildings with regard to fire.
- To establish methods of operating at fires in such buildings, and recommend precautions that should be taken.

According to this document there were three types of high-rise office buildings in New York City: 1) Class "E" built before 1945, 2) Class "E" built between 1945 and 1968, and 3) Class "E" built after 1968.[1] The WTC towers were built after 1968 and were in the third class. Construction characteristics of the post 1968 buildings are found in section 2.4 of the FDNY procedure. The following lists several construction details of a Class "E" high-rise building that are important to fire department operations:

- The construction techniques used in these buildings resulted in a "lightweight" building
- They were constructed with a lack of compartmentation.
- The protection of the structural steel component is usually done by sprayed fire-resistive material.
- Exterior walls or curtain walls constructed of a combination of glass and metal.
- The ceiling plenums of these buildings are extensive and lack fire stopping. They are used to return the air to the air-conditioning system and for electrical, communications and other building support equipment.
- Exterior windows usually can not be opened.
- Fire towers are not required.

[1] FDNY DCN: 3.02.01, Firefighting Procedures, High-Rise Office Buildings, Volume 1, Book 5, January 1, 1997.

- Floors are light in weight usually consisting of lightweight concrete
- Core construction techniques are used extensively.

The FDNY strategic operating plan for evacuation and firefighting for the first alarm Battalion Chief is presented in section 6.1 of the FDNY High-Rise Building document.[1] The following provides a brief summary of the FDNY Strategic Operating Plan. See the complete Strategic Operations Plan in Appendix I.

Strategic Operating Plan:

- Determine the specific fire floor or the floors on which smoke is reported from any information that is available to you in the building lobby.
- Verify the fire floor. Analyze information received from responsible occupant/building management personnel and/or the first arriving Ladder company. Determine the fire floor location as rapidly as possible. All future actions hinge on this vital information.
- Simultaneously, or as soon as possible, begin the process of controlling evacuation. Occupants of numerous floors may have self-initiated evacuation. Due to large floor areas or maze like corridors, occupants on the fire floor may be unaware of the fire until it is too late to evacuate. Search of large areas will be required. Search and evacuation of the floor above the fire will also be required.
- Gain control of the building systems: elevators, HVAC (Heat, Ventilation, and Air Conditioning system), communications, and fire pumps, confine and extinguish the fire.
- Experience indicates any serious fire will require a large commitment of units and equipment because of extensive logistic problems and a need for frequent relief of members.

In addition to these tasks listed above a Lobby Command Post is to be established and the Incident Command System is to be activated. The following FDNY procedure details information concerning the Lobby Command Post.[1]

Lobby Command Post:

The lobby command post is established by the arriving units inside the building and manned by each succeeding officer in command. From this post operations conducted in the building by Fire Department units are coordinated and controlled.

- The early establishment of a lobby command post will enable the chief in charge to exert central control over: evacuation, building systems, and the Fire Department units being deployed to locate, confine and extinguish the fire.
- To assist the lobby command post, it may be necessary to establish areas of command as follows: operations post, search and evacuation post, and staging areas.

- The lobby command post should provide the officer in command access to the following: the fire safety director, the fire safety plan, floor plans, the class "E" communications system, outside telephone lines, in-house telephone lines if available, building, elevator and window keys.

- The lobby command post shall be established at a location that provides the following: accessibility to incoming units, control of the elevators, control of the building fire command station, facilities for communications with all needed fire department communications and established operations posts and staging areas, the fire pump room, the HVAC control center, and the building occupants.

In addition to the establishment of the Lobby Command Post, Operations Posts are to be established within the high-rise building. The following procedure located in section 6.5 describes the Operations Post: [1]

Operations Post:

- It shall be established on the first floor below the fire, where conditions permit, and its location shall insure reliable communications with the operating units and the lobby command post.

- The chief in charge of the operations post shall be responsible for control, communications with, and coordination of the in building staging areas, and units operating on the fire floor and the floor above.

- Communications between the operations post and the lobby command post and the implementation of tactical procedures received from the lobby command post.

- Advising the lobby command post of conditions, problems and the need for additional units, and consult with the lobby command post about tactical procedures.

- Keeping in reserve an adequate number of units at the operations post for the orderly relief of units operating on the fire floor and the floor above.

As the Command Posts are established the FDNY Incident Command System also became established. The FDNY Incident Command System Manual, ICS Manual, Part 1, May 1997 [2] describes policies and the structure of the system. The following is extracted from the manual: FDNY INCIDENT COMMAND SYSTEM. The complete document is located in Appendix A.

FDNY Incident Command System Policy:

The FDNY Incident Command System policy provided guidelines and concepts to manage an incident in an efficient organized manner; the document describes the components, operating capabilities and functions of the New York City Fire Department Incident Command System (ICS). The Incident

[2] FDNY Incident Command System Manual, ICS Manual, Part 1, May 1997.

Command System was designed to improve firefighter safety by providing better accountability of personnel and improved use of resources and tactical effectiveness.

The policy provides a general description of the ICS organizational structure and describes the duties and responsibilities for each position at various types of incidents. The FDNY-ICS breaks down the system elements for managing an incident into 5 main functions: COMMAND, PLANNING, OPERATIONS, LOGISTICS, and FINANCE. It was the function of the initial Incident Commander, to implement the necessary parts of the ICS based on the needs of the incident. As the incident grows in complexity, the Command function is transferred to succeeding officers.

The FDNY Incident Command System described in this document was the official policy for the management of all incidents and the development of standard operating procedures that were in effect during the World Trade Center attack on September 11, 2001. The New York City Fire Department Incident Command System provided for the following kinds of operations:

- Single jurisdiction and single agency.
- Single jurisdiction and multi-agency.
- Multi-jurisdiction and multi-agency involvement.

This FDNY document stated that characteristic components of the Incident Command System policy interact to create a system that ensures optimum information management and control under normal or crisis conditions. Characteristics attributed to ensuring optimum information management and control are: common terminology, manageable span of control, modular organization, integrated communications, unified command structure, incident action planning, designated incident facilities, and resource management. During the WTC attack and operations, all of these Incident Command System procedures and policies were seriously challenged and experienced various degrees of performance.

The above procedures and policies represent the basis for FDNY operations at the WTC associated with the 2001 attack. Review of the procedures and policies and comparing them with the actions taken by FDNY at the WTC shows that the procedures and policies were, to a great extent, being followed with this extremely large and complex operation.

- In less than one hour FDNY had established three Lobby Command Posts, the original Lobby Command Post that was set up inside WTC 1, the second Lobby Command Post was set up inside of WTC 2, the third Lobby Command Post was set up inside the Marriott Hotel, a fourth FDNY Command Post was established on the street at the corner of West and Liberty Streets, and the Incident Command Post was set up near West and Vesey Streets in front of World Financial Center building two (WFC 2).[3, 4]

[3] FDNY Interview 7, winter 2004.
[4] FDNY Interview 62, winter 2004.

- The FDNY Field Communications unit had arrived and was functioning at the Incident Command Post in front of WFC 2.[5]

- FDNY had also set up an EMS Operations Post and they sectored the WTC area into four zones for operations regarding patient triage and treatment.[6]

- FDNY had also established staging areas for firefighting and EMS units, and EMS had called in a Mobile Emergency Response Vehicle (MERV) that established operations on Vesey Street between West Street and North End Avenue.[7, 8]

First-person interview data, FDNY documents, and media video support the premise that FDNY had established a functional Incident Command System when WTC 2 collapsed, and FDNY had the human and equipment resources committed for conducting high-rise operations at the WTC. However, the FDNY Incident Command System was hampered by the loss of the OEM Command Center, the lack of a fully functional Field Comm unit, poor radio communications, and limited access to shared information critical to operations.[9, 10] The collapse of WTC 2 not only caused the death of numerous citizens and emergency responders, but it totally disrupted the ongoing Incident Command System Operations being carried out by the Fire Department. The Lobby Command Post inside WTC 2 was destroyed and all of its personnel died in the collapse. Orders were issued to evacuate WTC 1, and the WTC 1 Lobby Command Post was abandoned. The Incident Command Post in front of World Financial Center 2 (WFC 2) was mostly destroyed by the collapse of WTC 2, and robust operations ended at that location. The FDNY Incident Command Post in front of WFC 2 was completely destroyed with the collapse of WTC 1, and several of the commanding officers, including the FDNY Chief of Department, died at this time.

6.2 PRE-PLANNING, TRAINING, AND STANDARD OPERATING PROCEDURES APPLIED AT THE WTC

High-rise buildings, such as the WTC towers, are complex structures that house many thousands of people. Detailed emergency planning for these types of buildings is needed to enhance the safety of building occupants and emergency responders. Building owners and operators, fire departments, emergency medical services, and police departments need well-developed pre-plans that address safety issues associated with these unique and potentially high-risk properties. Not only do these groups need to develop pre-plans for emergencies in high-rise buildings, they must be sure that each of the pre-plans appropriately link to form a cohesive and functional unified plan that will be successful when it is challenged by an emergency situation.

On September 11, 2001, the initial responding fire department companies were familiar with operations within the WTC and were familiar with the emergency plans for the towers. Many of the firefighters had been inside the towers before on previous operations. The Port Authority had conducted pre-planning for

[5] FDNY Interview 61, winter 2004.
[6] FDNY Interview 49, winter 2004.
[7] McKinsey & Company, *Increasing FDNY's Preparedness*, New York, August 2002.
[8] FDNT Interview 55, winter 2004.
[9] FDNY Interview 45, winter 2004.
[10] FDNY Interview 58, winter 2004.

building emergencies in the towers and had worked with FDNY, particularly after the 1993 bombing, to enhance safety at the buildings. As part of FDNY's document "Firefighting Procedures, High-Rise Office Building,"[1] a section refers to the "Strategic Operations Plan" for high-rise operations. This plan established operations practices that were designed to link with the building owner's high-rise emergency plan.

Some key elements of FDNY pre-planning for high-rise building operations relate to:

- planning for operations with the high-rise building's safety personnel
- planning for operations with building security personnel
- planning for operations with the local police department
- knowing the construction and physical layout of the building,
- understanding the building's fire alarm and protections systems,
- understanding the building's standpipe systems, fire pumps, hookup points, in-house firefighting resources, and the overall firefighting water supply,
- understanding the design and operations of the building's emergency communications system,
- understanding the building's evacuation plan, elevators, stairways, and other building egress ways
- plan for the safe use of fire department controlled elevators
- knowing the capabilities of fire department radios and other means of communication as it relates to building design and locations where radio signals become lost or attenuated, and
- information on the building's HVAC system, its function, and means of building ventilation.

Procedures for Implementing the Strategic Operating Plan

The FDNY document "Firefighting Procedures, High-Rise Office Buildings" has a detailed description of how the Strategic Operating Plan was to be implemented. Listed below are some of the key factors for how the fire department was to put the plan into operation. The following was extracted from the FDNY document entitled "Firefighting Procedures, High-Rise Office Buildings," January 1997.[1] Also see section 6.1 that lists details of the strategic operations plan and Appendix I.

- The first arriving Battalion Chief was responsible for implementing the strategic operating plan, and the Battalion Chief was to position operations at the lobby command post. From this post, there would be control over all building systems through the fire safety director or a surrogate. The Battalion Chief would receive first-hand information about other problems that might develop on floors above the fire through the building communications networks.

The Chief would have liaison with the Police Department for control of the lobby and the streets in the vicinity of the fire building.

- The first arriving Battalion Chief would be required to make an initial size up to determine the adequacy of the response and the need for additional response.

  A 10-76 signal would be transmitted when a report of fire is confirmed. Any fire in a high-rise office building which requires the stretching and operating of one hose line would necessitate the use of "All Hands."

  A second alarm would be warranted for any visible fire or smoke emanating through the exterior skin of the building or when a serious fire had been verified.

  Because of the large number of occupants in high-rise office buildings, even fires of a minor nature might require additional units to prevent unnecessary evacuation and panic.

- The first arriving Battalion Chief would be also required to establish liaison with the fire safety director if present, or a surrogate to determine the following:

  Has the fire floor definitely been determined?

  What is the extent of the evacuation that has been implemented?

  Have there been any reports of severe life hazards?

  What is the status of the elevators and the HVAC system?

  Are there any access stairs in the vicinity of the reported fire floor?

  What communications have been established between the fire floor and the lobby command post?

  What communications have been established between the lobby command post and the occupants of the building?

- Under normal fire situations in high-rise buildings, the Battalion Chief would arrange for the fire safety director or the evacuation supervisor to make an announcement over the PA system or the intercom system. "This is your Fire Safety Director, Dr. John Doe. The New York City Fire Department has just arrived to extinguish a fire on the floor. As they obtain information, we will pass it along to you. If your assistance is required, I will make such an announcement. In the meantime, please remain calm at your place of employment." In WTC 1, the intercom system was not functioning, and therefore, an announcement of this type could not have been communicated. In fact, there is no evidence that this type of message was delivered. In WTC 2, there is no evidence from the several announcements made from the Fire Command Desk in the building that a message containing this content was communicated.

- The fire department also had a high-rise operations check list that would be used for obtaining additional information critical for operations in the fire building. The first arriving Battalion Chief would make use of this check list as soon as possible to advance the collection of additional information needed for operations.

The Port Authority had prepared an extensive pre-plan manual for emergency procedures at the WTC. The original manual was prepared in 1988 and had been updated annually. The manual had already been updated during 2001 and this revised plan was in effect on September 11, 2001. The manual was entitled, "World Trade Center Emergency Procedures Manual 2001,"[11] it contained plans for natural disasters and a full range of other threats to the buildings. A copy of this Port Authority emergency procedures manual are contained in Appendix J. In addition, the plan highlighted cooperation between PAPD, FDNY, and NYPD.

Firefighter Training

At the time of the 2001 WTC attack, FDNY had several training programs to prepare its members for operations inside high-rise buildings. The basic Probationary Firefighter School curriculum gave new personnel a minimum of 25 weeks of training. This training provided basic skills that were needed by a firefighter for operating under the direction of a Company Officer in a high-rise firefighting environment. A second level of training consisted of the "First Line Supervisors Training Program" which was directed at training company officers. In this program, the officers received approximately eight hours in training that focused on high-rise firefighting. The third level of training on high-rise operations was for Battalion Chiefs and consisted of training associated with the department's 40-plus page document on high-rise firefighting. A copy of this document is located in Appendix I. The Battalion Chief training dealt with building design and construction, working with building fire safety directors, communications, incident command, use of fireman service elevators, stairways, evacuation, Ladder company operations, and firefighting operations.

[11] Port Authority of New York and New Jersey, *World Trade Center Emergency Procedures Manual 2001, New York, NY.*

Chapter 7
EMERGENCY COMMUNICATIONS AND ANALYSIS

7.1 INTRODUCTION

On September 11, 2001, radio and telephone communications played a significant role in the operations of emergency responders at the World Trade Center (WTC). Radio and telephone communications were a primary means of communicating information to emergency responders. These forms of communication were also used by emergency responders to communicate with people trapped in the WTC buildings and people attempting to evacuate from the buildings. They were used to communicate between members of the same emergency responder departments for planning and operations at the WTC, and they were used to communicate between different departments or responding organizations.

Each of the governmental departments that had emergency responders at the WTC—New York City Fire Department (FDNY), New York City Police Department (NYPD), and the Port Authority Police Department (PAPD)—depended on their ability to communicate to accomplish their mission and to obtain information related to operations safety during the attack. Personnel from each of the departments used radios, cellular phones, and wired or landline telephones for communications during the WTC operations. Other forms of communication at the WTC included the warden telephone system, and the use of Blackberry communications systems. In addition, the emergency responders relied on the most basic form of communication, direct face-to-face communications.

As a normal practice during a typical emergency response many radio and telephone communications are recorded by the respective departments that respond to an incident. These recordings are normally made by the departments to provide an accurate record of operations during an incident. These records are often used by departments during review of department operations. They are also used for investigative purposes and are sometimes used as evidence in legal cases. During the attack on the WTC, many of the emergency responder communications were recorded and preserved. This study is based on these recordings. In addition, information gathered by personnel from the NIST, during first-person interviews with more than 100 emergency responders has contributed to the report.

7.1.1 Objectives

The objective of this section is to develop a better understanding of the role that emergency communications played during the response to the WTC attack, and to quantify information related to communications effectiveness.

Many factors are associated with the ability of emergency communications to be successful. The following objectives were set in this report:

- To document radio and telephone communications operations,
- To document radio communications readability or understandability,

- To quantify radio communications traffic volume,
- To understand the impact of traffic volume on communications readability and the transfer of information,
- To identify communications associated with dispatch and arrival of responders,
- To identify communications related to evacuation and emergency response operations, and
- To identity communications related to building conditions at the WTC and the impact of this information on the emergency response.

7.1.2 Telephone and Radio Communications Recordings

Both the Port Authority of New York and New Jersey (PANYNJ) and the NYPD supplied copies of audio recordings from the emergency response operations at the WTC. The PANYNJ provided digital copies of the audio communications tapes recorded by them during operations on September 11. These recordings included communications from emergency response personnel, maintenance personnel, PAPD personnel, and a recording of the FDNY Channel 7 / PA, WTC Channel 30 radio repeater that was located at the WTC. The FDNY Channel 7 and PA, WTC Channel 30 radio frequencies are the same radio communications frequencies. The FDNY Channel 7 designation represents the actual tuning knob switch location on the fire department's handie-talkie radios. The Port Authority identified this same repeater channel as Channel 30 as a result of the PA radio communications system architecture. The FDNY Channel 7 / PA, WTC Channel 30 repeater frequency was a FDNY city-wide channel designated for use in high-rise building operations. This repeater was installed because FDNY handie-talkie radio communications within the WTC towers was relatively poor, and the radio repeater would increase transmission power improving the radio signal. The combination of increased radio transmission power and the location of the repeater antenna outside of the WTC buildings on top of WTC 5 provided better radio coverage for the complex and increase the likelihood that FDNY personnel working inside the towers would be able to communicate with others while using their handie-talkie radios. The Port Authority had installed this radio repeater system at the WTC for use by FDNY after the 1993 bombing.[1, 2]

Because telephone communication (both landline and cellular phone) was a contributing part of the emergency communications process during the WTC attack, NIST received copies of telephone emergency response communications from the PANYNJ. Identification information for these recordings is listed in Attachment 3.

The NYPD submitted their communications to NIST in the form of audio tapes copied from the original tapes recorded on September 11, 2001. These tapes included radio communications from NYPD Special Operations, Division One, and city-wide operations.

[1] PA Interview 2, fall 2003.
[2] PA Interview 11, fall 2003.

FDNY communications recordings were not available from the WTC location on September 11, 2001, because the primary Field Communications truck was in the shop for repairs and a backup Field Communications van was used in its place. The backup Field Communications van did not have the capability to record the on-scene incident command or tactical communications. Also, the backup van was destroyed when the towers collapsed. Therefore, the best record of radio communications available to NIST on FDNY operations at the WTC came from the FDNY Channel 7 high-rise repeater / PA, WTC Radio Channel 30 tape and accounts provided by FDNY personnel during their interviews. The Channel 7 / Channel 30 tape provides a limited amount of information on FDNY communications and operations at the WTC, but it does provide insight into FDNY operations inside WTC 2. NIST also received the FDNY Manhattan radio dispatch channel recordings for the period just prior to the WTC attack until the time when WTC 1 collapsed.

Each audio communications file was received from the source with the starting and ending times marked on the media jacket or the surface of the media. A list of all communications recordings acquired from the various departments is found in Attachment 3 at the end of the report.

The City of New York provided NIST with opportunities to review their telephone recordings for 9-1-1 Emergency Operators and FDNY fire dispatchers in their New York City offices.

7.2 TELEPHONE COMMUNICATIONS

7.2.1 Accounts of Telephone Communications

There were 116 first-person interviews conducted with emergency responders who reported to the WTC on the morning of September 11, 2001. The following information was drawn from these interviews:

- Before the attack occurred on the WTC, both the landline and cellular systems appeared to be working normally.

- Only moments after the first aircraft impacted WTC 1, the landline and cellular telephone systems were stressed by increased caller volume making it difficult to get messages through. This condition continued for many hours following the attack.

- Telephone calls from the WTC to the 9-1-1 emergency operators and statements from various individuals being interviewed show that even though WTC 1 and WTC 2 were severely damaged by the aircraft impact and fires, many of the landline telephones in the buildings continued to work up until the collapse of WTC 2.

The following is from emergency responder first-person interviews and deals with telephone communications from inside WTC 1:

  - One of my guys called up on the warden phone. There was one on every floor in the building and you can call the Lobby Command Post with it. He called but he couldn't get through and we went to the Verizon

Company on the 23rd floor and he called the Manhattan dispatcher on the phone and told them to pass a message to the Lobby Command Post.[3]

- I didn't have a dial tone. So I went into another office there and I called the fire dispatcher and got through on a regular telephone. This was around the 18th floor. We could not get through on the radio, and I am sure they had their hands full down there at the Lobby Command Post.[4]

- After the collapse of WTC 2, a number of cellular phone systems were not functional in the area of lower Manhattan. A number of emergency responders attempted to use their cellular phones to make calls since they were unable to communicate using their radios. Many of these attempts were unsuccessful either due to failure of the cellular phone system or the high communications traffic volume that occurred.

- After the collapse of WTC 2, there were still some landline telephones working within the city block areas adjacent to the WTC site.

7.2.2 PAPD Police Desk Telephone Calls

Throughout the operations, while the PAPD Police Desk in WTC 5 was staffed and just before the collapse of WTC 2, the police desk was receiving radio and telephone calls concerning building occupants, building conditions, and operations. Most of the telephone calls related to operations and the location of people in the buildings. However, there was another category of telephone calls coming in that distracted the Police Desk operators from their efforts to save lives: calls from the news media. These included calls from news organizations in the immediate area and other locations on the east coast of the United States. In addition, there was a telephone call from a radio talk show on the West Coast and another telephone call from a news service in Europe. The PAPD Police Desk personnel tried to be helpful but also attempted to transfer the callers to another telephone number for assistance. These efforts took valuable time and potentially delayed critical communications with the emergency responders at the scene.

7.2.3 New York City 9-1-1 Emergency Telephone System

The New York City 9-1-1 Emergency Telephone System also was flooded with telephone calls and experienced periods where the system was stressed by the number of incoming calls.[5,6] The New York City 9-1-1 Emergency Telephone Center was staffed as usual with dozens of telephone operators who received incoming calls and determined if the calls were for NYPD, FDNY, or EMS. Each 9-1-1 operator had a computer for logging in calls, transferring written information, and the ability to switch telephone

[3] FDNY Interview 29, winter 2004.
[4] FDNY Interview 35, winter 2004.
[5] NYPD Interview 13, winter 2004.
[6] NIST review of 9-1-1 tapes, 2004.

calls to the appropriate city department.[7] As emergency calls were being switched, the 9-1-1 operators would monitor the call to insure that it was responded to by the assigned department.

On the morning of September 11, 2001, telephone calls received from people trapped inside the WTC towers were transferred to the FDNY dispatchers. Information concerning injured and trapped people was collected by the FDNY dispatchers, the information would be evaluated, and then the dispatcher would attempt to transmit the information to the FDNY Incident Command Post or to the Field Comm unit located at the Incident Command Post in front of WFC 2. Since the radio communications system also was experiencing problems with a large volume of radio traffic, all information did not get through to the people who needed it. Additionally, the large amount of incoming data presented a problem for FDNY dispatchers related to evaluating and retransmitting the information to all individuals needing it. Once information was transmitted by the FDNY dispatchers and received by the FDNY WTC Incident Commander, FDNY units were assigned to go to a specific location and assist the trapped or injured occupant (s).

7.3 RADIO COMMUNICATIONS

In general, emergency responders felt that their equipment was adequate for the operations they were carrying out before the WTC towers collapsed. There was one notable exception: this was the FDNY handie-talkies used throughout the department by Chief Officers down to the first line firefighter.

7.3.1 Handie-Talkie (HT) Radios Used by FDNY on September 11, 2001

FDNY personnel knew from years of experience - including their communications experience during the 1993 bombing of the WTC - that the handie-talkies used by the department did not work well inside high-rise buildings. (Fusco 1993) Buildings containing large amounts of steel and reinforced concrete are known to attenuate radio communications signals. Radio signals also may be attenuated by electromagnetic interference and radio signal reflections, and each of these attenuation modes can be found in large cities with high-rise buildings. The radios used by FDNY during the 1993 bombing and until March 14, 2001, were Motorola Saber 1 and Saber 1E models. These radios had the following attributes:

- Operating frequency - 150 MHZ, VHF band
- Type of operation - analog with 1 Watt of output power
- The radios had seven radio channels distributed as follows: Six channels were simplex or point-to-point operation channels; one channel was a duplex or repeater channel which used a 153 MHz transmitter frequency and a 154 MHz receiver frequency.

Table 7–1 shows the HT operating channels and radio frequencies as specified in FDNY A.U.C. 179 Utilization of Company Handie Talkie[8]. The complete document is located in Appendix K. It should be noted that this document was in abeyance as the result of a March 22, 2001, FDNY order. However,

[7] NYPD Interview 15, winter 2004.

[8] Fire Department City of New York, DCN 4.0306, Utilization of Company Handie Talkie, A.C.U. 179, July 1996.

the document was the basis for Company handie-talkie radio usage during the WTC attack on September 11, 2001.

Table 7–1. HT radio frequency allocation and use.

	Channel	Frequency
1	Universal Handie - Talkie	153.83 MHz
2	City Wide Base	154.43 MHz
3	Queens Mobile	154.40 MHz
4	Manhattan Mobile	154.01 MHz
5	Brooklyn Mobile	153.95 MHz
6	Staten Island Mobile	154.07 MHz
7	Hi - Rise Repeater	TX 153.89 MHz RX 154.43 MHz

Note: In the table above, TX refers to the transmit frequency and RX refers to the receive frequency.

The radio channel is set on the handie-talkie radio by rotating a control knob at the top of the radio.

In addition to these VHF band HT frequencies FDNY was using the following communications frequencies on September 11, 2001: Manhattan Fire 154.25 MHz, Brooklyn Fire 154.37 MHz, Bronx Fire 154.19 MHz, and Staten Island Fire 154.19 MHz.

On March 14, 2001, FDNY began to field new 400 MHz band handie-talkie radios. They were Motorola model XTS 3500 R radios with the following attributes:

- Operating frequency band - 400 MHZ, UHF.
- Type of operation - digital operation.
- Transmitter output power - 2 Watts and 5 Watts.
- The radios had 16 communications channels of which channels 15 and 16 were not assigned. The remaining channels were assigned as follows: channels 1 through 3 were all Borough fireground tactical and command channels; channel 4 through 8 were assigned as specific Borough fireground channels; channel 9 was the future high-rise in-building repeater channel; channel 10 was the Battalion mobile repeater channel; channels 11 and 12 were subway repeater channels; channel 13 was EMS/fire fireground; and channel 14 was the railroad repeater channel.

On March 19, 2001, a FDNY firefighter using the new 400 MHz digital radio became trapped during firefighting operations. The firefighter used his radio and called Mayday several times but was not heard. The firefighter was rescued, but the failure of this Mayday to get through raised questions about the new radio's capabilities.[9] On March 21, 2001, the new 400 MHz band radios were recalled by FDNY and

[9] Written Communication from New York City, October 6, 2004.

were replaced by the Saber radios previously used by the department for a period of about 10 years.[10] These were the radios used by FDNY during emergency operations at the 1993 WTC bombing. These Saber handie-talkie radios were used by FDNY during the September 11, 2001, attack on the WTC. The poor operating performance of these older radios in high-rise buildings was well known to firefighters and chiefs, and raised concerns by many personnel that the radios would not perform well during the WTC operations. Their concerns were proven to be valid.

The following is a statement drawn from the emergency responder first-person interviews and concerns communications in high-rise firefighting environments:

- It was stated that communications in high-rise fires had been a problem as long as the interviewee had been on the department, so it was not a surprise that they had problems at the WTC on the morning of September 11, 2001.[11]

In addition, FDNY management, selected chiefs, and Field Comm were using some Motorola UHF, 800 MHz, analog radios for command communications.[12] These radios were used on a trunking system that processes the radio communication and then routes the message as it is being retransmitted by the system. These 800 MHz radios were not used by FDNY fire and rescue companies operating inside the WTC complex. However, it was being used by FDNY command personnel for communications during WTC operations. FDNY informed NIST that the FDNY 800 MHz command radio traffic was not recorded during the WTC operations on September 11, 2001.

As mentioned earlier, another component of the FDNY radio communications system used on September 11, 2001, at the WTC was the high-rise repeater system located in WTC 5. Communications through the WTC high-rise repeater were carried out with the use of the Saber handie-talkie radios discussed above. The handie-talkie radio's channel selector switch would be set on Channel 7, which would allow communications through the high-rise repeater system.

7.3.2 Radio Repeater Systems Used by FDNY at the WTC

FDNY had instituted several efforts to improve communications inside high-rise buildings. They worked with building owners and encouraged them to install building/complex repeater systems that would assist with building radio communications. The PANYNJ installed a building/complex repeater system for FDNY following the 1993 bombing. This repeater system was designed to provide 95 to 98 percent coverage for the WTC site.[13] In addition, FDNY conducted tests to evaluate the repeater's performance and found it to be acceptable.[14] In addition, FDNY developed what they referred to as the "battalion car cross-band repeater" that also could be used to enhance radio communications inside of high-rise buildings. In a 1998 article, Battalion Chief Orio J. Palmer of FDNY wrote about the use of repeater

[10] Written Communication from New York City, October 6, 2004.
[11] FDNY Interview 34, winter 2004.
[12] Written Communication from New York City, October 6, 2004.
[13] Port Authority of New York and New Jersey written communication, August 1, 2005.
[14] Letter from Stephen M. Gregory, FDNY, to Alan L. Reiss, PANYNJ, dated January 19, 1994.

systems to improve radio communications during high-rise operations. The following is a quote from his WNYF article: [15]

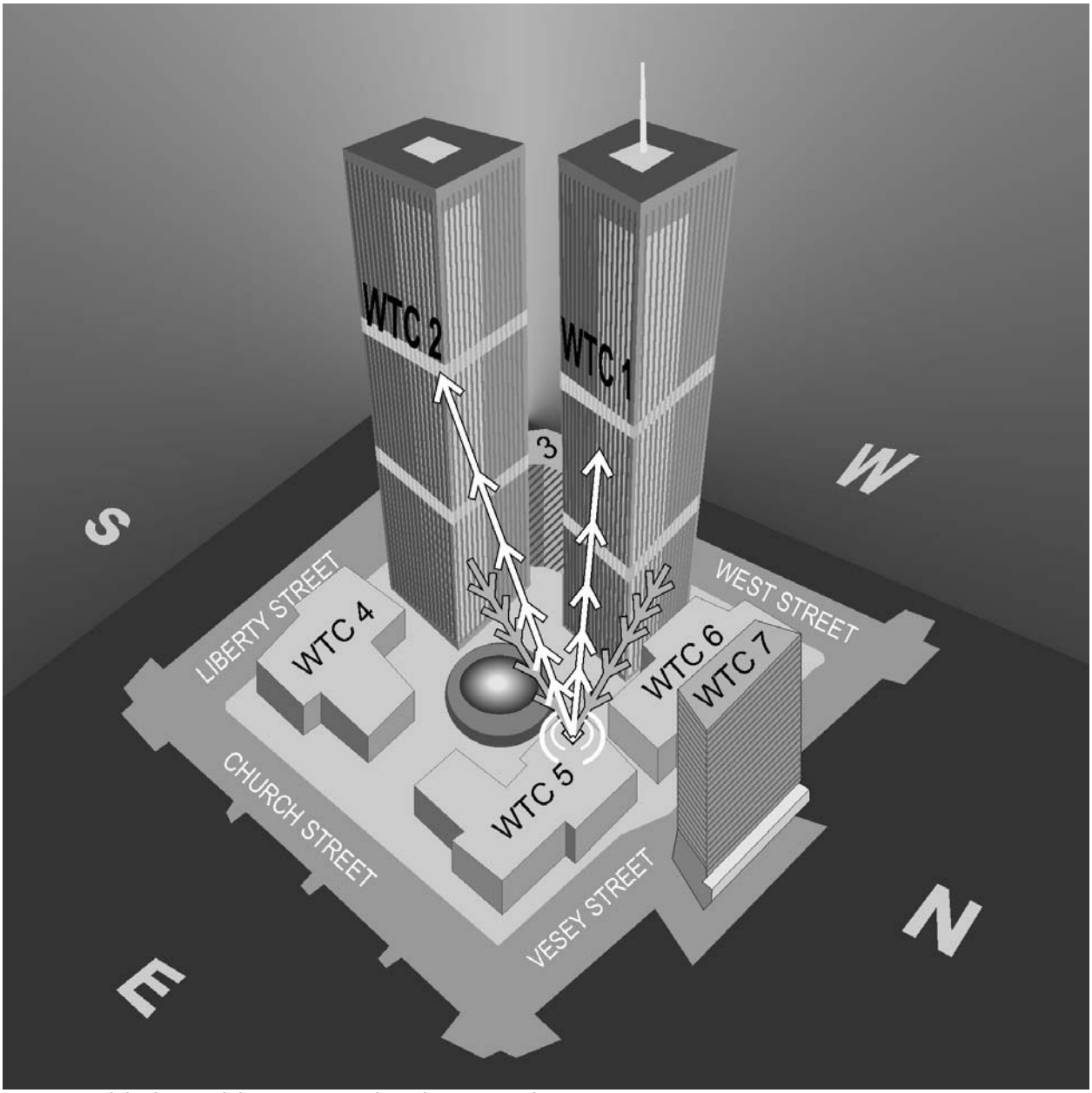
> "The primary use of the battalion car repeater was to assist the Incident Commander in the lobby of a high-rise building in communicating with members on the upper floors when transmissions were affected adversely by the building. If the battalion car with the installed cross-band repeater is positioned approximately 60 feet from the building, there is a much greater chance of the battalion car repeater receiving a one-watt signal form a handie-talkie transmitting from an upper floor than any handie talkies located within the building at the lobby command post (LCP). The signal does not have to pass through numerous floors of steel and steel-reinforced concrete."
>
> "The battalion car cross-band repeater is not a cure-all for communications in high-rise buildings or large complexes, but the UHF radio may provide a link between the lobby command post and remote members where no link exists."

Two different radio repeater systems were used at the WTC during the 2001 operations. One was the building/complex radio repeater system installed at the site by the PA, and the second was the battalion car cross-band repeater (Figures 7–1, 7–2, and 7–3). The following are descriptions of the two systems.

7.3.3 Building/Complex FDNY Radio Repeater

The WTC/FDNY high-rise repeater was located inside WTC 5 and the antenna for the repeater was located on roof of WTC 5 and was aimed up and directly at WTC 1 and 2.[16] With this antenna configuration, the repeater provided coverage for both towers. The repeater was a Motorola base station model MSR 2000. It had an output power of approximately 50 watts. The radio repeater was a duplex design having an input receive frequency of 154.430 MHz and an output transmit frequency of 153.890 MHz. Note that the receive frequency was exactly the same as that of the FDNY Channel 2 command frequency and the FDNY City Wide base frequency. This repeater had three different locations where it could be turned on and operated.[17] Two were located at the tower's Fire Command Desks, one in the lobby of WTC 1 and one in the lobby of WTC 2. The third repeater control point was located at the PAPD Police Desk inside WTC 5.

[15] Palmer, Orio J., Battalion Chief, *Repeater Systems*, WNYF, 3rd edition, FDNY, New York, 1998.
[16] PA Interview 2, fall 2003.
[17] PA Interview 2, fall 2003.



Source: Original artwork by Marco Crupi. Enhancement by NIST.

Figure 7–1. Illustration showing the location of the FDNY WTC high-rise repeater antenna at the site.

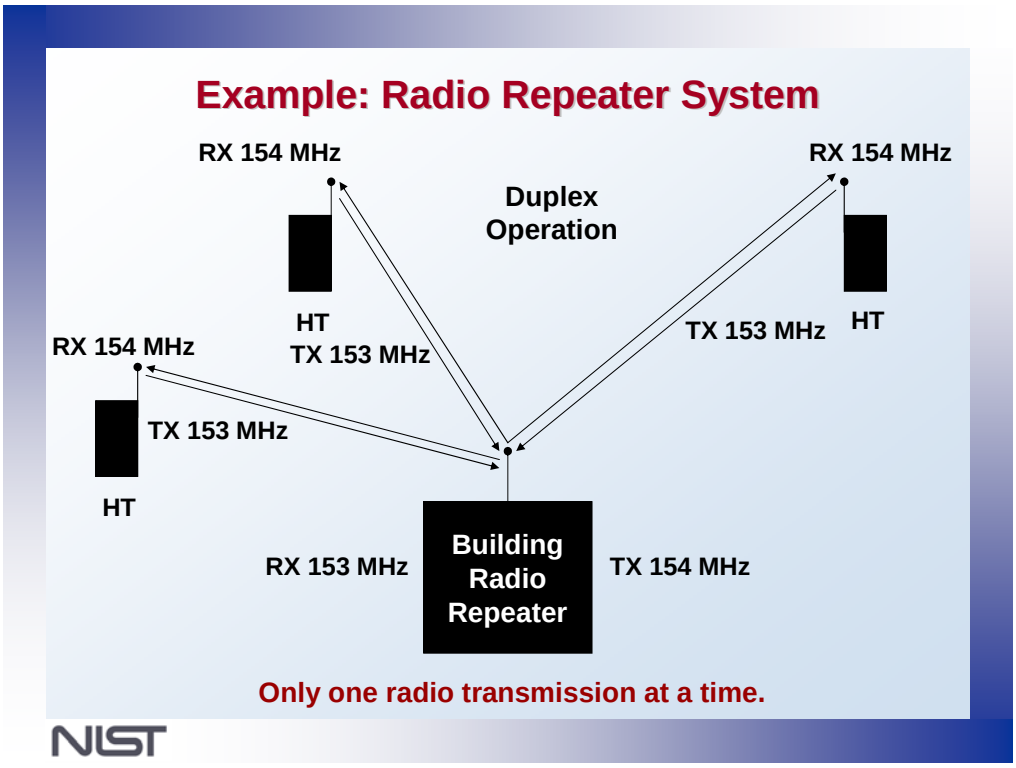


Figure 7–2. Example of a FDNY high-rise repeater.

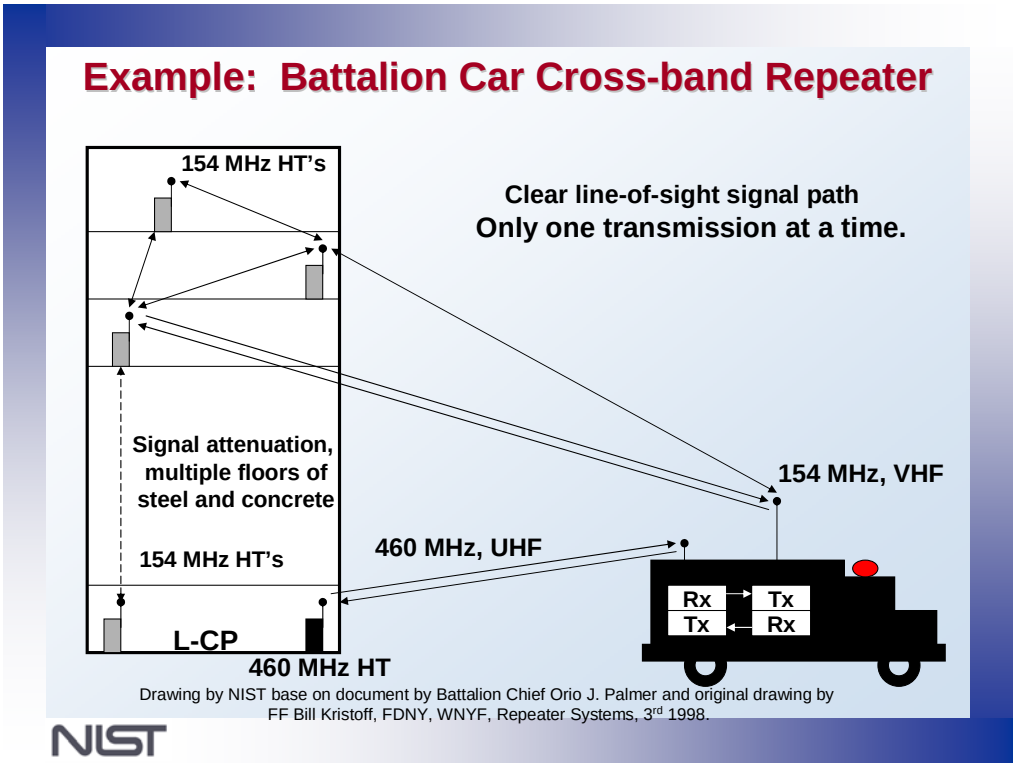


Figure 7–3. Example of a Battalion car cross-band repeater.

7.3.4 FDNY Battalion Car Cross-Band Repeater

The FDNY Battalion car cross-band repeaters operated on the VHF band input or receive frequency of 154.430 MHz and an UHF output or transmit frequency of 460.625. The car repeater system consisted of two units the receiver/transmitter and band/frequency conversion part and a UHF handie-talkie that could be removed from the vehicle and carried into the building's Lobby Command Post.[15] The most important feature of the Battalion car cross-band repeater was not that it amplified the radio signals from the Lobby Command Post to the upper floors of a high-rise building, but that it could receive a one watt radio signal from the upper floors of a high-rise building and retransmit it to the Lobby Command Post that normally would not be able to receive the signal. This would allow for two-way communications.[15] Battalion Chief Orio Palmer pointed out the following critical issue when comparing the operations of the two different repeater systems:

> "The crucial difference between the battalion car repeater and a building/complex repeater is that the battalion car repeater- - even if not operating properly or if improperly positioned - -will not affect communications adversely. This is not the case when using channel 7 and a building/complex repeater system. If the building/complex repeater system malfunctions, all communications on channel 7 cease." (Palmer 1998)

The above provides necessary basic information for understanding the function of radio systems used by FDNY during the attack on September 11, 2001, and helps in understanding issues related to questions concerning the function of the WTC/FDNY high-rise radio repeater.

7.3.5 Function of FDNY Radio Repeater Systems

After the towers had collapsed and 2,749 people were killed (including approximately 421 emergency responders and building security personnel), the questions raised were as follows: (1) whether the WTC/FDNY repeater was actually working, (2) if the repeater had been working would radio communications have been better, and (3) would emergency communications made using the repeater have saved the lives of WTC occupants and FDNY personnel inside WTC 1?

Based on the information gathered throughout this investigation - both documentary and first-person interview data - and the repeater's radio operations recording recovered from the WTC 5 rubble, the following is an assessment of what occurred concerning operation of the WTC/FDNY repeater system:

Question (1) Was the WTC/FDNY repeater actually working?

- Prior to the WTC attack on the morning of September 11, 2001, and before the WTC/FDNY repeater was activated inside WTC 1, the Port Authority repeater recording system was recording radio communications made by the FDNY City Wide radio channel, 154.43 MHz. It also recorded radio transmissions coming from the Monmouth County, New Jersey Fire Department.[18] This indicates that the repeater recorder was collecting communications from these other sources for the period after the repeater was activated inside WTC 1 by FDNY. This is supported by the repeater's recording. The fact that these other communications were being recorded by the WTC/FDNY repeater's recording system complicates the analysis of the repeater's operation. Another complicating factor is that the FDNY Battalion Car Cross-Band repeater also used the 154.43 MHz frequency as its receiving frequency.

- When the first FDNY personnel entered WTC 1, a Chief Officer, believed that there would be communications problems at the WTC towers and requested that the repeater system be turned on.[19]

- A FDNY member went to see that the repeater was turned on.

- Radio transmission analysis conducted by NIST and the Port Authority communications personnel showed that at approximately 8:53 a.m., a 1450 Hz audio tone was transmitted indicating that the F4 button on the repeater's phone console had been pressed to activate the repeater. (Note: The repeater's phone console was designed to transmit a series of audio tones that were received and transmitted by the repeater. These tones identified operational functions of the repeater and the console.)

- At approximately 8:55 a.m., 8:56 a.m., and 9:04 a.m., the repeater console phone's handset was operated and sent out a 2175 Hz audio tone.[20]

- At approximately 9:05 a.m., two FDNY Battalion Chiefs using the Fire Command Desk's Vega, Model C-514B Four-Frequency Tone-Remote Control Console and their FDNY handie-talkies checked the repeater's operation.[21] See the photograph in Figure 7–4 that shows the speaker phone and handset assembly sitting on top of the Fire Command Desk console.

- The repeater check was carried out inside the lobby of WTC 1 with the two Battalion Chiefs standing only a short distance from each other.[22] As this radio check was started, the WTC/FDNY high-rise repeater recorded the 2175 Hz tone generated by pressing the hand set button followed by another 1450 Hz audio tone indicating that the F4 button that activates the repeater had been pressed again. Following these tones, one Battalion Chief attempted to call

[18] Other Interview 2, winter 2004.
[19] FDNY Interview 7, winter 2004.
[20] FDNY Channel 7 / PA, WTC Channel 30 radio communications recording.
[21] FDNY Channel 7 / PA, WTC Channel 30 radio communications recording.
[22] FDNY Interview 7, winter 2004.

the other Battalion Chief who was listening on his handie-talkie. During this exchange of radio calls (that were recorded by the repeater's recording device), another Chief Officer who identified himself as being in a WTC lobby said that he could hear the radio transmissions. This was followed by the second Battalion Chief attempting to call the first Battalion Chief. This exchange was repeated approximately three additional times.

Figure 7–4. Video image of the WTC 1 Fire Command Desk and the FDNY repeater speaker phone, at left, sitting on top of the console.

- After multiple attempts to establish communications using the WTC/FDNY high-rise repeater console's handset, the first Battalion Chief called to the second Battalion Chief using his handie-talkie and indicated that he didn't think the repeater was working:

  > "I don't think we have the repeater. I picked you up on my radio but not on the hard wire."[23]

  This indicates that the listening part of the repeater hand set may not have been functioning or was not adjusted to provide adequate volume to hear the communication. However, if each of the Battalion Chiefs had their handie-talkie radios set to channel 7 and the first Battalion Chief heard the transmissions over his handie-talkie, this indicates that the repeater was working. During this exchange of radio communications, the two Chiefs established that FDNY Channel 2 would be the command channel for operations inside WTC 1 and that the Battalion Car Cross-Band repeater would be taken to WTC 2. Channel 2 on the FDNY handie-talkies was the city-wide base channel that was being recorded by the repeater's recorder prior to the attack, and it also was the repeater's receive or input frequency.

[23] FDNY Channel 7 / PA, WTC Channel 30 radio communications recording.

- This plan to take the Battalion Car Cross-Band repeater to WTC 2 left the Lobby Command Post inside WTC 1 with no repeater to use for communicating with personnel on the upper floors of the building. The only evidence that the Battalion Car Cross-Band repeater may have been used came from a radio message at 08:56 a.m. made by the second Battalion Chief over the 154.25 MHz channel to the Manhattan dispatcher that stated the following:

  > "I am going to stay on the Cross-Band repeater of the Battalion Car as a back-up to the building repeater."[24]

- Based on interviews with FDNY personnel, WTC 1 established its communications in the following fashion: FDNY Channel 1 became the tactical channel and Channel 6 became the command channel in WTC 1.[25] FDNY Channel 2 became the tactical channel and Channel 4 or 5 was the command channel for WTC 2.[26, 27] FDNY Channel 7 was not used again inside WTC 1 but appears to have been used inside WTC 2. In addition, FDNY Channel 3 or 6 was used for the tactical channel inside the Marriott.[28]

- The second Battalion Chief was dispatched to operate inside of WTC 2 and he left to assist with operations in that building.

- At approximately 9:17 a.m., radio communications were established inside WTC 2 by the second Battalion Chief and his aide using the WTC/FDNY high-rise repeater input frequency and the FDNY Channel 2 frequency 154.43 MHz.[29] The clear exchange of radio communications from the Battalion Chief located on the 40th floor to his aide located somewhere below shows that the repeater was working or exceptional point-to-point communications inside WTC 2 were occurring. The repeater communications recording system recorded a complete communications exchange between the two FDNY personnel. No 2175 Hz tones were recorded indicating that the officer and the aide were both using their handie-talkies for communications. This communication was followed by many additional radio communications that were recorded by the repeater's recording system between personnel on the upper floors of WTC 2, other locations in the building, and the lobby of WTC 2. These communications continued until seconds before the collapse of WTC 2 when the repeater system went silent.

The following is a statement extracted from emergency responder first-person interviews concerning WTC/FDNY high-rise repeater operations: (Note: The firefighter was operating inside WTC 1.)

> - Usually when you get the repeater it's supposed to be on channel 7, but we were never told. They said that the repeater system was not working,

[24] FDNY Channel 7 / PA, WTC Channel 30 radio communications recording.
[25] FDNY Interview 20, winter 2004.
[26] FDNY Interview 20, winter 2004.
[27] FDNY Interview 62, winter 2004.
[28] FDNY Interview 31, winter 2004.
[29] FDNY Channel 7 / PA, WTC Channel 30 radio communications recording.

> but I was not sure. I got clear messages from handie-talkies, and I'm assuming the repeater was on.[30]

NIST studied three suggested theories as to why the repeater system did not seem to function correctly that morning:

- The antenna system was damaged when the aircraft struck the towers, and communications were not possible inside of WTC 1.
- The repeater console handset was broken
- The volume on the repeater console handset was turned down.

From the above data, it can be stated that the repeater was operating inside of WTC 1 when the repeater check was underway. The first Battalion Chief transmitted radio communications using the console handset, which was recorded, and that another Chief Officer called to the two Battalion Chiefs and stated that he could hear the radio transmissions. The first Battalion Chief could not hear communications over the repeater console handset that he was using inside WTC 1.[31]

Since (1) the radio communications were being heard by others, (2) the repeater system was recording the exchange of calls between the two Battalion Chiefs, and (3) the operating tones were being transmitted and recorded by the repeater recording system, there is strong evidence that the repeater was working and that the communications difficulties were associated with the repeater console handset. However, with the information available, there is no way to conclusively determine the exact performance of the WTC/FDNY building radio repeater system that was used on the morning of September 11, 2001. Also, it is not possible to determine whether the handset was broken or if the volume was turned down since the repeater's handset was destroyed by the building collapse. It is likely that the handset either had a malfunction and/or the handset listening volume was not turned up high enough to allow the user to hear the returning radio transmissions.

Related to the possibility of radio antenna damage causing a problem, one should note that radio communications using the WTC/FDNY repeater system were carried out on the inside of WTC 1 and inside of WTC 2. These radio communications were recorded by the repeater's recording system from each location. Therefore, it is likely that the antenna and repeater system was functional and not disabled as a result of damage from debris produced by the impact of aircraft.

Question (2) If the repeater had been working would radio communications have been better?

The recording of radio communications by the WTC/FDNY repeater system suggests that communications for operations inside of WTC 2 were assisted by the repeater. Also, the radio recordings show that communications readability using the repeater was generally good with readability often reaching levels of 3 to 5. (See section 7.4 concerning the assessment of radio communications quality.) Where readability levels were lower, it was generally caused by doubling or multiple people attempting to

[30] FDNY Interview 17, winter 2004.
[31] FDNY Interview 7, winter 2004.

communicate over the repeater at one time. If FDNY personnel in both of the towers attempted to use the WTC/FDNY repeater for operations, there likely would have been additional radio traffic resulting in more unreadable communications. (Note: The term "unreadable" is used in this document to identify radio or other forms of telecommunications that could not be understood by persons receiving the message.) However, it would have been likely that the Lobby Command Post located in WTC 1 might have had somewhat improved communications with personnel operating up inside the building until the time when WTC 2 collapsed. The radio repeater recording suggests that the WTC/FDNY high-rise repeater failed during the collapse of WTC 2. Additionally, if personnel inside both towers had been attempting the use the same repeater at the same time, firefighters might have become confused as to which communication related to operations inside which tower. During the first-person interviews, several firefighters indicated that at times they were unsure as to which tower they were really working in. This difficulty with identifying which tower was which is also demonstrated by a series of radio transmissions recorded by the WTC/FDNY high-rise repeater where a Chief Officer and his Aide attempted to communicate which tower they were in to the WTC 2 Lobby Command Post.

Question (3) Would emergency communications made using the repeater have saved the lives of WTC occupants and FDNY personnel inside WTC 1?

With the collapse of WTC 2 and failure of the WTC/FDNY repeater system, the Lobby Command Post inside WTC 1 would have lost its primary means of communicating with personnel operating inside of WTC 1. On that morning of September 11, the Lobby Command Post inside WTC 1 was not operating through any radio repeater system while communicating with personnel under its command. Therefore, since the WTC/FDNY repeater appeared to fail with the collapse of WTC 2, it would have had no effect on saving lives of occupants or FDNY personnel located inside WTC 1. Additionally, if the repeater system had been in use inside WTC 1 when WTC 2 collapsed, it would have taken time to establish that the repeater system had failed, and FDNY personnel inside WTC 1 would have had to change radio channels to continue radio communications. This need to change radio channels may have complicated the transmission and reception of emergency evacuation orders given over the radio for personnel inside WTC 1.

Evidence supporting these findings concerning the FDNY radio repeater systems at the WTC also suggests radio communications options that may have advanced the ability of FDNY to communicate. This raises the question: What basic radio system would have assisted FDNY personnel inside each tower to successfully communicate during operations at the WTC?

The magnitude of events on September 11, 2001, was greater than anything experienced previously by emergency responders in New York City. Emergency response operations were focused on multiple and parallel tasks, WTC 1 and WTC 2. This suggests that FDNY needed a capability for handling a large amount of communications traffic, requiring a minimum of two separated radio repeater systems functioning on a minimum of two different pairs of radio frequencies. The separate repeaters would double the capability of FDNY to communicate with personnel inside the buildings, and the different pairs of radio frequencies would prevent radio interference between the two repeater systems. One of these repeater systems would have been operated at WTC 1, and the second would have operated at WTC 2. In addition, the Incident Command Post would need to be able to monitor radio traffic on each of these repeater systems and be able to transmit emergency messages to all personnel by overriding fire ground radio traffic. The radio used for overriding radio communications on the fireground would have a

higher output power than the handie-talkies and the repeaters in use at the site. This radio that would have been located outside the WTC buildings could have been used to transmit emergency messages and evacuation orders to firefighters inside the buildings. The options discussed here provide one basic approach to improving communications for multiple operations during a large emergency response operation.

7.3.6 Communications, Command and Control

Communications in a high-rise building emergency is a critical part of command and control and is a key element of the Incident Command System.

The following statement was extracted from an emergency responder first-person interview and relates to the issue of communications and command and control:

- Control is always a big issue with operations, but if we have communications, we will be able to control any operation.[32]

High-rise buildings are known to create problems with radio communications. The vast amount of metal and reinforced concrete in high-rise buildings is known to attenuate and block radio signals. This is often a problem with low output power emergency responder handie-talkies. Various documents including information from the 1993 WTC bombing highlighted the problems that FDNY experienced with radio communications in high-rise buildings. (Fusco 1993) (Palmer 1998) On September 11, 2001, FDNY again experienced poor handie-talkie radio communications within the towers. This had a major impact on FDNY operations particularly inside of WTC 1 where no one used the WTC radio repeater system. At WTC 2, the FDNY/WTC radio repeater system was successfully being used for operations.

Emergency responders reported that they had difficulties with the communications systems from the time they arrived at the WTC, and the difficulties became progressively worse. [33] There were problems communicating with firefighters as they climbed higher in WTC 1. There were no communications with the elevators, and attempts to use the wire line phones to call upstairs were unsuccessful. [34] Radios worked when communicating with other emergency responders in close proximity, only a few floors apart. As FDNY personnel attempted to communicate with others located more than about five floors from them, they would have to move around inside the building to find locations where radio signals could get through. [35] They needed areas with line-of-sight without reinforced concrete and steel between them. At times, they tried to set up line-of-sight communications relays. [36] Some of the locations where radio communications appeared to work were inside stairways and next to windows. [37]

[32] FDNY Interview 14, winter 2004.
[33] FDNY Interview 43, winter 2004.
[34] FDNY Interview 2, fall 2003.
[35] FDNY Interview 7, winter 2004.
[36] FDNY Interview 30, winter 2004.
[37] FDNY Interview 33, winter 2004.

The following statements were extracted from emergency responder first-person interviews and relate to radio communications inside the WTC towers:

- The interviewee stated that he never had good radio nor telephone or any other form of communication in the building to the floors above the lobby of WTC 1. At best, radio communications were poor. Throughout the time of operations in the building, handie-talkie radio communications was a negative factor. If communications were better, more firefighters would have been saved… People went between Command Posts with messages to determine conditions and deliver orders. The best form of communications was face-to-face between the Command Post and the other building, WTC 2.[38]

- The interviewee had trouble inside WTC 1 with handie-talkie radio communications. He could not talk with this commanding officer or anyone at the command post. His radio did work with people working near him since they used a different tactical channel and established radio calls or IDs unique to their operations.[39]

- Inside WTC 1, I heard a muffled message on my radio that there was a mayday, get out of the building, the south tower has come down. The guys standing around me, said, what was that? I said, I think they were saying, get out of the building and the other guys said they didn't get it on their radios, and I said that I got it. There were Brooklyn units stationed on the floors below and were waiting orders to proceed and they never heard the radio transmission to exit the building as far as one of the officers told me.[40]

- There was no effective form of communication that day. First of all, when you work for a FDNY company near by and you go into the WTC buildings for a sprinkler discharge, as soon as you walk into the lobby, the first companies get one of their Port Authority radios. So right away you know when you walk in there your radio in no good. Right there in the lobby, they have seven of their radios. They are attached to the building repeater. So those radios were compatible with the Port Authority's building repeater, and our FDNY WTC site repeater wasn't compatible with the Port Authority radios. You know if you have a fire in the building, you can't communicate with the FDNY radios. With the FDNY radios, you can communicate from floor to floor, but not lobby to wherever the fire is. It's out of our range. Say you have a small fire in WTC 1 on an upper floor that would be a 2nd alarm and you have 60 people with 7 radios. What good is that?[41]

[38] FDNY Interview 2, fall 2003.
[39] FDNY Interview 3, winter 2004.
[40] FDNY Interview 9, winter 2004.
[41] FDNY Interview 29, winter 2004.

Radio Traffic

In addition to the poor operating characteristics of the handie-talkie radios inside of high-rise buildings, emergency responders also were struggling with the high volume of radio traffic. This was due in part to the design of the FDNY radio system. Figure 7–5 below shows an example how radio communications may be structured by the Fire Department during a two-alarm firefighting operation. When evaluating this figure, it should be remembered that there were many more people attempting to use the radio system than shown in the example. There were firefighters at the WTC complex representing three five-alarms and one two-alarm. All of these firefighters were attempting to communicate over the FDNY radio system before WTC 2 collapsed. An example of staffing for a single five-alarm fire would be approximately four battalions dispatched to yield a total of 20 Engine companies and 8 Ladder companies at the scene. Each tower was assigned one tactical radio channel and one command radio channel. At minimum, there were about 40 FDNY companies trying to communicate over each of the tactical radio channels during the WTC operations, and only one person could talk at a time.

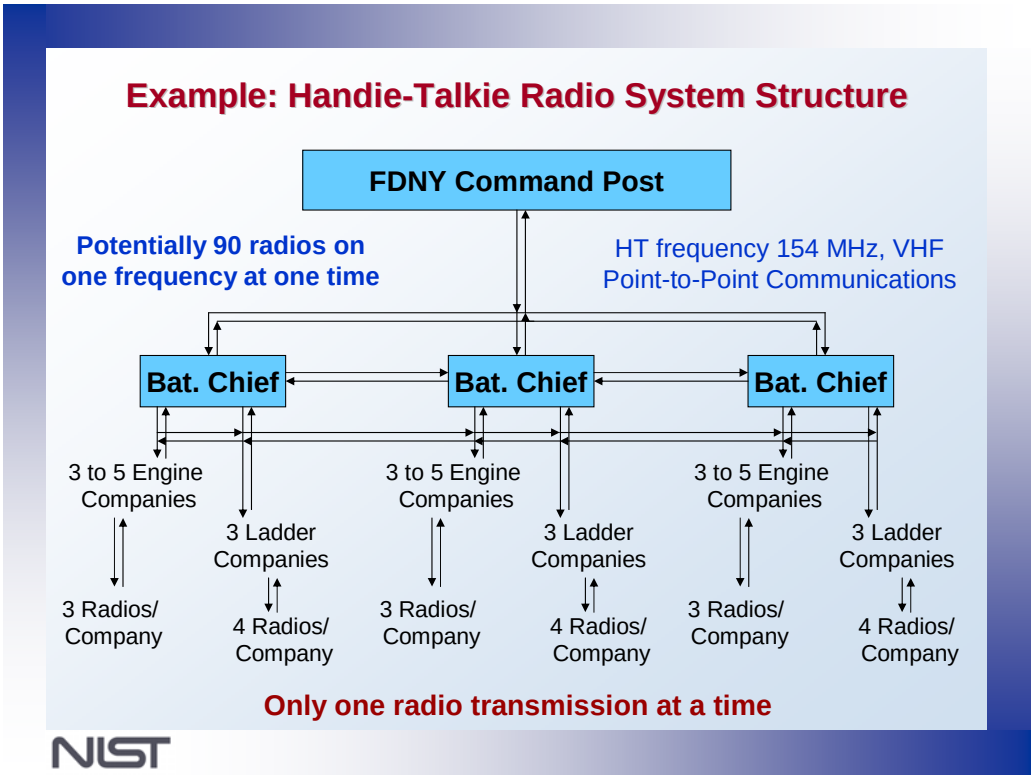


Figure 7–5. Example of handie-talkie radio communications for a two-alarm fire.

Emergency responders reported that they experienced extreme radio traffic on September 11, 2001. Too many people were trying to communicate at once, and the handie-talkie channels were overwhelmed. [42] People were stepping on other people's radio transmissions, and feedback was a problem, making those transmissions that did get through incomplete. [43, 44]

[42] FDNY Interview 19, winter 2004
[43] FDNY Interview 38, winter 2004

The following statements were extracted from emergency responder first-person interviews concerning the level of radio traffic they experienced during their WTC operations: (Also see section 7.5 that follows and provides quantitative data on radio traffic.)

- I never saw him again. I couldn't get him on the radio. There were too many people trying to talk at once. Radio communications were almost non-existent.[45]

- Radio communications that day were terrible; you couldn't get a word in. There were so many people talking on the radio and everything was jammed up. Radio reception was really bad, also.[46]

- Radio traffic was unbearable at that point. I was trying to call headquarters to ask for portable handie-talkies and flashlights and some uniformed firefighters to set up a much larger Command Post somewhere outside in the immediate area. I had a lot of trouble trying to call headquarters.[47]

- On the radio I heard, "Evacuate the building." Then everyone around me was like, did you hear that, "evacuate the building?" Then you couldn't get on the radio because everyone was calling everyone. It was like radio gridlock.[48]

Radio Communications and Incident Command and Control

The poor radio communications at the WTC had a serious impact on the Lobby Command Post's attempts to maintain command and control. The following statement extracted from an emergency responder first-person interview addresses this issue:

- The radio communications from up inside the building were sporadic and ineffective. Any direction the Lobby Command Post gave over the radio was sporadic and a lot of the information transmitted was not acknowledged. So they didn't know whether the messages got through, and it was frustrating.[49]

The Lobby Command Post inside WTC1 repeatedly tried to call the different Battalion Chiefs that were up in the building. Neither the interviewee nor the other two FDNY Chief Officers at the Lobby Command Post ever got an acknowledgement for the calls.[50] During the call to evacuate WTC 1, some units did respond over the radio to the call to evacuate.[51] The photograph Figure 7–6 shows an

[44] FDNY Interview 58, winter 2004
[45] FDNY Interview 29, winter 2004
[46] FDNY Interview 30, winter 2004
[47] FDNY Interview 60, winter 2004
[48] FDNY Interview 39, winter 2004
[49] FDNY Interview 20, winter 2004
[50] FDNY Interview 20, winter 2004
[51] FDNY Interview 7, winter 2004

FDNY/EMS member attempting to communicate from the lobby of WTC 1 by holding his radio high in the air.

Figure 7–6. Video image of a FDNY/EMS member attempting to communicate using his handie-talkie radio inside the lobby of WTC 1.

In Figure 7–6, note that the FDNY/EMS member is holding the radio's microphone that is attached to an extension wire in his right hand at mouth level as he attempts the communication.

7.4 ASSESSMENT OF RADIO COMMUNICATIONS QUALITY

The Readability, Signal Strength, and Tone system for rating the quality of radio communications is used widely throughout the field of radio communications and is described in The ARRL Handbook for Radio Communications (ARRL 2003). This system is broken into three distinctive groups that can be rated: Readability, Signal Strength, and Tone. The rating for "Tone" is only used to identify the quality of radio communications for "Continuous Wave" transmissions, and it does not apply to this analysis as "Tone" does not relate to voice communications. For voice radio communications, only "Readability" and "Signal Strength" are used. "Signal Strength" is usually read from a signal strength meter at the time of the actual radio communication and is not available on the audio recordings.

Thus, in this study, "Readability" was used for rating the primary emergency responder radio communications channel recordings. It is recognized that this form of analysis is subjective, and it relates to the ability of an individual to hear and understand the radio communications. In an attempt to minimize the influence of the subjective rating system, individuals with extensive experience using radio communications and project staff trained by the experienced personnel were used to conduct the analysis. In addition, communication periods from the various recorded data sets were reviewed by more than one person where radio communications readability was difficult.

The rating table for communications readability is listed below (ARRL 2003):

Readability (the term "readable" means "understandable")**:**

- 1 – Unreadable (A term meaning the communication is not understood.)
- 2 – Barely readable, occasional words distinguishable
- 3 – Readable with considerable difficulty
- 4 – Readable with practically no difficulty
- 5 – Perfectly readable

7.4.1 Training of Transcribers

Four NIST personnel were used to transcribe the emergency responder communications files. This included the project leader and three other staff personnel. The transcription protocol listed above was planned and tested by the two senior NIST personnel, including the project leader. When the protocol was found to be acceptable, the two other NIST personnel were trained by the senior members of the group. After the basic transcription training was completed, each of the new transcribers was given a communications file to transcribe. This communications file had previously been transcribed by the two senior personnel. After the file was transcribed by the new transcriber, their results were compared to that transcribed by the senior personnel. When it was demonstrated that the new transcriber had a full understanding of the transcription process, they were then assigned communications files to transcribe.

7.4.2 Radio Communications Concepts

Currently, the only way for most emergency responder radio systems to produce a totally clear communication (one can be received and understood) is for one communications signal to be transmitted at a time on a given radio frequency. This means only one person can transmit a radio message at a time to avoid communications interference on that radio frequency. If two or more radio transmissions are made on the same radio frequency at the same time using these systems, signal mixing may occur and the communications may not be understandable. This difficulty with radio communications often is referred to as doubling. Under these conditions, usually the radio with the highest transmitting power will override transmissions from the lower-power radios and only the highest-power radio signal will be heard. This is often the case where an emergency response radio system uses a higher-power base station for dispatch communications or where a repeater is used to amplify a radio system's signal output. Where multiple radio communications are received by a radio repeater, signal mixing is likely to occur and the communications will not be understandable (ARRL 2003).

Over the last several years, radio communications technology has undergone some significant advancement, particularly with cellular phones. These new systems can increase the effective use of the radio frequency/time factors related to radio communications (ARRL 2003)], and are now beginning to be applied to emergency responder communications equipment.

7.4.3 Communications Data Analysis

This analysis of communications addresses four major areas: (1) radio traffic volume, (2) transmission time periods, (3) readability of communications, and (4) the development of a chronology of radio communications from the emergency responders conducting operations related to the WTC attack.

The first two factors, radio traffic volume and communications duty cycle, are directly related. Each has an impact on readability as well as the ability to understand and deal with the information being communicated. Generally, as radio traffic rate increases, the operations duty cycle approaches overloaded conditions. With very high traffic volumes, it becomes more difficult for personnel at central communications facilities and personnel in the field to respond to the volume of traffic. Human operators of communications equipment become overloaded with work. Not only do the operators have to verbally communicate with personnel over the radio, but they must often transfer the information gained to other locations. The transfer of information also may be done verbally using other communications systems, by hand through keyboard inputs, or simply face to face. Analysis of the radio traffic for each of the departments shows periods where radio traffic rates during the surge conditions potentially resulted in situations where base station radio operators were unable to relay important information.

7.4.4 Emergency Response Communications Chronology

This chronology provides information on communications difficulties experienced by NYPD, PAPD, PA Security, PA Operations, and PA Vertical Transportation units following the attack on the WTC. Much has been published concerning the communications difficulties experienced by FDNY at the WTC, and first-person interviews with FDNY personnel confirm some of these difficulties. However, this chronology shows that FDNY was not the only emergency responder department that experienced radio equipment and communications difficulties. There are reports of radios not working well and communications showing that some personnel were not being heard or responded to. Also, some of the radio transmissions demonstrate the failure to communicate as a result of radio traffic surge conditions.

The chronology provides examples of numerous cases where radio transmissions were not understood because of “crossing or doubling” of radio signals when too many people are trying to talk at one time.

8:45 a.m. PAPD police desk: requests a radio check to locate an open microphone on a handie-talkie radio. [Note: This occurred just before the aircraft struck WTC 1.] (PAPD Radio Channel W)

8:49 a.m. WTC Security requests, as a result of the surge in radio traffic volume, that police officers stay off the air. (PA/WTC Security Radio Channel X)

PAPD police desk Channel W: extended period with an open microphone, lots of background noise and people talking. (PAPD Radio Channel W)

8:50 a.m. PAPD police desk receives a message that the officer did not copy the previous transmission and asks what is going on. (PAPD Radio Channel W)

8:51 a.m. NYPD Special Operations Division: a dispatcher advises a police lieutenant that his message was crossed and to repeat it. A message came through that he can't get a hold of someone on the cell phone. (NYPD SOD Radio Channel)

8:53 a.m. NYPD Special Operations Division: a dispatcher advises a police department truck that their radio message is cutting off and all that the dispatcher got was something about the upper floors. (NYPD SOD Radio Channel)

8:54 a.m. WTC Security is reporting that it is having trouble reading incoming radio transmissions. (PA/WTC Security Radio Channel X)

WTC Security receives a message that an officer is having trouble reading radio messages because of so much commotion on the floor. (PA/WTC Security Radio Channel X)

8:55 a.m. A Battalion Chief says, I am going to stay on the Cross-Band repeater of the Battalion Car as a back-up to the building repeater. (FDNY channel 7 / PA/WTC Channel 30)

8:59 a.m. NYPD Special Operations Division: a dispatcher advises a police truck that their radio message is breaking up, and the dispatcher asks what units he wants to respond. (NYPD SOD Radio Channel)

9:00 a.m. NYPD Special Operations Division: dispatcher advises that various units are crossing each other and that the dispatcher cannot understand them. (NYPD SOD Radio Channel)

9:01 a.m. WTC Operations: a microphone is stuck open, interfering with communications. (PA/WTC Operations Radio Channel Y)

9:02 a.m. NYPD Special Operations Division: a police officer asks the dispatcher if the last transmission was heard. The police office asks twice. There is no answer. (NYPD SOD Radio Channel)

9:03 a.m. WTC Operations receives a report that someone has found a supervisor's radio that has been lost. (PA/WTC Operations Radio Channel Y)

NYPD Special Operations Division: an officer in an NYPD car requests that units give their messages slowly. (NYPD SOD Radio Channel)

9:05 a.m. FDNY chief officers conduct tests of the City-wide, high-rise repeater located at the WTC. (PA/WTC Channel 30 radio recording)

9:07 a.m. NYPD Special Operations Division: a police officer requests that the air be cleared for emergency vehicles and personnel unimpeded. (NYPD SOD Radio Channel)

9:08 a.m. NYPD Special Operations Division: a dispatcher advises officers directing traffic that they are coming over the air. Approximately 30 seconds later the dispatcher advises a second time that the officers directing traffic are coming over the air and requests that they stop. (NYPD SOD Radio Channel)

9:09 a.m. NYPD Special Operations Division: a Special Operations Division officer requests that the dispatcher designate two channels for this emergency, one for units on the scene and one for units that are responding. (NYPD SOD Radio Channel)

9:11 a.m. NYPD: a backup transmitter for City-wide communications is put into service in anticipation of potential problems with the primary transmitter. (NYPD McKinsey& Company, 2002)

9:12 a.m. NYPD City-wide: a dispatcher advises that "We need to keep this frequency clear unless it is in regards to the level four mobilization." (NYPD City-wide Radio Channel)

NYPD Special Operations Division: dispatcher states "Only emergency transmissions are to be made on this frequency." (NYPD SOD Radio Channel)

FDNY Chief begins using the FDNY channel 7 repeater while working inside WTC2. (PA/WTC Channel 30 radio recording)

WTC Security receives a radio report from the Fire Command Desk in the lobby of WTC 2 that they cannot pick up the Warden phones and that they are making announcements telling people not to stay at the Warden phones. Note: This communication indicates that the Warden phones in WTC 2 were not working. (PA/WTC Security Radio Channel X)

9:15 a.m. PAPD police desk: a radio microphone is stuck open. (PAPD Radio Channel W)

9:19 a.m. NYPD Special Operations Division: a dispatcher advises a police officer that his message was being cut off and that only part of the message was copied. (NYPD SOD Radio Channel)

9:20 a.m. NYPD Special Operations Division: a dispatcher advises that there is an open carrier and the units should check their radios. (NYPD SOD Radio Channel)

9:22 a.m. NYPD Special Operations Division: a dispatcher advises a police truck that his radio message was unreadable. (NYPD SOD Radio Channel)

NYPD Special Operations Division: the dispatcher advises a second time that there is an open carrier and that messages are not being understood. (NYPD SOD Radio Channel)

9:23 a.m. NYPD Special Operations Division: the dispatcher advises that the two frequencies are the Manhattan IO (Interoperability Channel) and the City-wide. The dispatcher also advises that the various units are crossing. (NYPD SOD Radio Channel)

9:25 a.m. PAPD police desk: a radio microphone is stuck open and interfering with communications. Radio signals are garbled and broken, and there is a high level of background noise. (PAPD Radio Channel W)

9:30 a.m. WTC Security Radio Channel X has a communication indicating that everybody should turn their phone off.

9:31 a.m. WTC Security: a Port Authority officer is questioned as to whether they have brought any red bags with radios for the fire department. The answer is no, and is it safe to go into the building. (PA/WTC Security Radio Channel X)

9:32 a.m. NYPD City-wide channel: a unit advises that he cannot communicate, his radio is going in and out and the cell phone is not working. (NYPD City-wide Radio Channel)

9:36 a.m. NYPD Special Operations Division: a police officer reports that the telephones at his location are not working. Note: Location not identified. (NYPD SOD Radio Channel)

9:43 a.m. NYPD Special Operations Division: a police officer advises that he heard over an AM radio that a plane had crashed into the Pentagon. (NYPD SOD Radio Channel)

9:49 a.m. PAPD police desk instructs officer that he was speaking too fast and that he must slow down so that he could be understood. (PAPD Radio Channel W)

9:53 a.m. NYPD Special Operations Division: the dispatcher advises all units to check their portable radios for an open carrier. (NYPD SOD Radio Channel)

9:54 a.m. NYPD City-wide channel: a dispatcher requests "Keep the air clear. We have problems in the City. Keep the air clear right now." NYPD City-wide Radio Channel)

9:55 a.m. WTC Vertical Transportation: personnel are having trouble reading communications over the radio and indicate that they will try to call on the telephone. PA/WTC Vertical Transportation Radio Channel Z)

9:57 a.m. WTC Security: a report is received that an officer is responding to WTC 1 Fire Command and that he had been trying to contact the Command Center on floor 22, but they didn't know how to operate the other set of communications equipment. (PA/WTC Security Radio Channel X)

9:59 a.m. WTC 2 collapsed. (FEMA 403)

9:59 a.m. NYPD Special Operations Division: an Emergency Service Unit police officer calls several times for the dispatcher. The dispatcher answers each time and apparently was not heard by the calling unit. (NYPD SOD Radio Channel)

10:03 a.m. NYPD Special Operations Division: a dispatcher requests that some units standby while the needs of other units are addressed. (NYPD SOD Radio Channel)

10:05 a.m. NYPD Special Operations Division: the dispatcher advises that all units need to talk one by one. The dispatcher further advises that units are cutting each other off. (NYPD SOD Radio Channel)

10:09 a.m. NYPD Special Operations Division: an Emergency Service Unit advises the dispatcher that he can hear the dispatcher but is not sure if the dispatcher is hearing him. (NYPD SOD Radio Channel)

10:10 a.m. NYPD Special Operations Division: the dispatcher advises that there are three units trying to talk at the same time and requests, "One at a time." (NYPD SOD Radio Channel)

7.4.5 PAPD Radio Communications

All radio communications evaluated for this report experienced traffic volume surge conditions as a result of the WTC attack. The traffic volume surge greatly exceeded the traffic volume experienced under normal operating conditions.

PAPD Channel 26/W was used to demonstrate typical radio communications and operational conditions that occurred with the PAPD minutes before the terrorist attack, during the attack, and during operations that followed the WTC attack. This radio channel is used by PAPD police officers, NYPD supervisors and FDNY Engine 10 and Ladder 10 for communications at the WTC site. Table 7–2 and Table 7–3 compare the number of transmissions and their length of time before and after the first aircraft impacted WTC 1. The percent of radio transmissions versus time is in Figure 7–7. This figure and others give the rate of radio transmissions over a 40 minute period, 20 minutes prior to the first airplane impact and 20 minutes after the impact. This percent of radio transmission, as well as others discussed in this report, was calculated as the sum of transmission time and no transmission time over the total period of time. These data show that there was an approximately 13 percent rate of radio transmissions on the PAPD police desk channel for the 20 minutes prior to the aircraft impact. After the first aircraft impact on WTC 1, the radio communications were occurring 80 percent of the time. This surge in communications significantly impacted the functional capability of the radio system. After approximately 10 minutes, communications dropped to a steady operating level of approximately 48 percent capacity.

7.4.6 FDNY Radio Communications

The communications for the FDNY City-wide high-rise building radio Channel 7 was recorded by PAPD on their Channel 30. The Port Authority installed this high-rise repeater at the WTC for FDNY following the 1993 bombing. This FDNY channel was used primarily by FDNY personnel during operations in WTC 2. Personnel using this channel were FDNY chief officers, company officers, aides, and firefighters.

While looking at these data, it is important to keep in mind that several FDNY personnel at the WTC did not think that the WTC complex high-rise channel radio repeater was working. This is based on radio communications tests that were conducted by two Chief Officers working inside WTC 1 when the first Command Post was being set up in that lobby. A record of this radio communications test was recorded on the PA/WTC Radio Channel 30 tape. Following this radio test, a Chief Officer involved in the test chose to use different channels for command and tactical communications. However, as FDNY operations increased in WTC 2, it was determined by members of the FDNY that the high-rise channel was functioning and use of the channel developed.

Traffic load for this FDNY channel is summarized in Table 7–2 and Table 7–3. The percent of radio transmissions versus time is shown in Figure 7–8. The radio communications on the repeater channel prior to the first airplane impact could have been operations at other high rises in the city or radio transmissions from the Monmouth County, New Jersey Fire Department that shared the radio frequency.

Table 7–2. Comparison of radio transmissions before and after the first aircraft impact.

Department	Number of transmissions before first aircraft impact (20 min period)	Number of transmissions after first aircraft impact (20 min period)
PAPD, Ch. 26/W	42	176
FDNY, Ch. 7 high-rise	39	134
FDNY, Manhattan Dispatch	25	258
NYPD Division 1	171	225
NYPD Special Operations Division	72	192

Table 7–3. Comparison of average and maximum radio transmission times before and after first aircraft impact.

Department	Average time per transmission before first aircraft impact (s)	Average time per transmission after first aircraft impact (s)
PAPD, Ch. 26/W	3.8 (maximum 21.8)	3.3 (maximum 19.7)
FDNY, Ch. 7 high-rise	3.8 (maximum 50.9)	3.1 (maximum 19.5)
FDNY Manhattan Dispatch	4.9 (maximum 21.7)	3.1 (maximum 22.6)
NYPD Division 1	5.3 (maximum 19.0)	3.4 (maximum 12.6)
NYPD Special Operations Division	2.8 (maximum 22.3)	5.7 (maximum 31.5)

Note: All minimum transmission times were typically less than 1 s and were often related to the keying of a microphone.

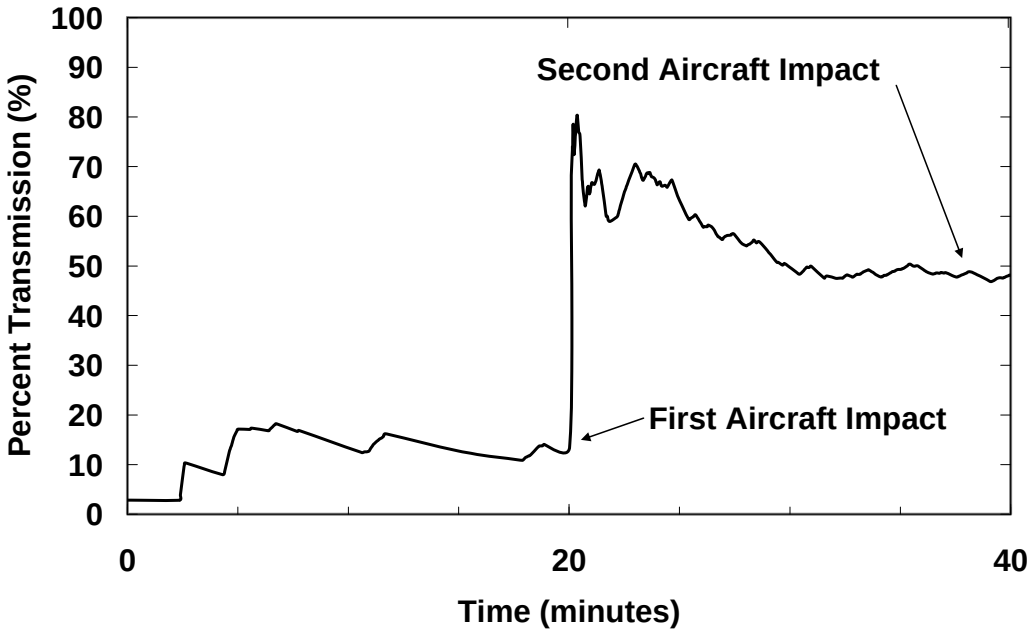


Figure 7–7. PAPD Police Desk channel 26/W plot of percent transmission versus time.

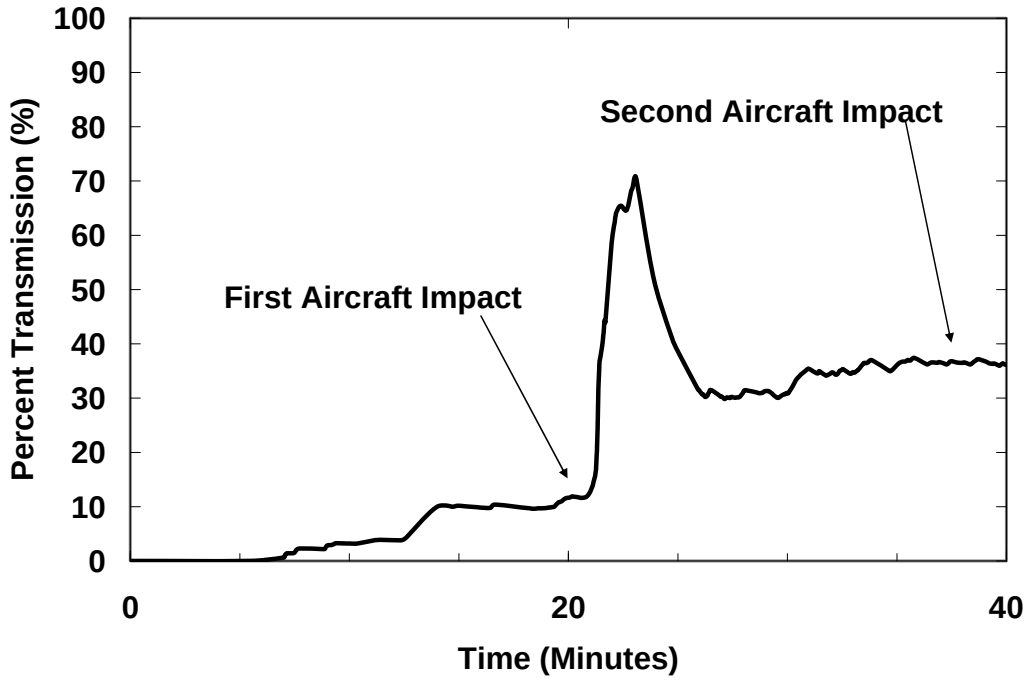


Figure 7–8. FDNY City-Wide High-Rise channel 7 (PA/WTC Radio Channel 30) plot of percent transmission versus time.

The following is from a first-person interview that dealt with fire department communications:

> - High-Rise firefighting operations are transmitted on 154.430 MHz. This is the frequency that is used by the high-rise repeaters and one of the frequencies used by the Battalion Chiefs Car Repeater. This high-rise frequency is not used very often because it will interfere with other local area fire departments that are also using the frequency. This is the primary turnout frequency for the Monmouth County, New Jersey Fire Department that is located about 25 to 35 miles from here.[52]

In the analysis of the 20 minutes after the first airplane impact there appears to be several instances where the communications recorded on this channel originated from other fire departments.

7.4.7 NYPD Radio Communications

The third example illustrates radio communications for the NYPD Division 1 channel and the NYPD Special Operations Division channel. The Division 1 channel was used by police officers and supervisory police officers. The Special Operations Division channel was used by senior level NPYD management, supervisory police officers, Emergency Service Unit personnel, and aviation unit personnel.

[52] Other Interview 2, winter 2004

Table 7–2 and Table 7–3 compare the number of transmissions and their length of time before and after the first aircraft impacted WTC 1 for both of the NYPD channels. Figure 7–9 and Figure 7–10 give the percent transmissions versus time for the NYPD Division 1 and NYPD SOD channels, respectively.

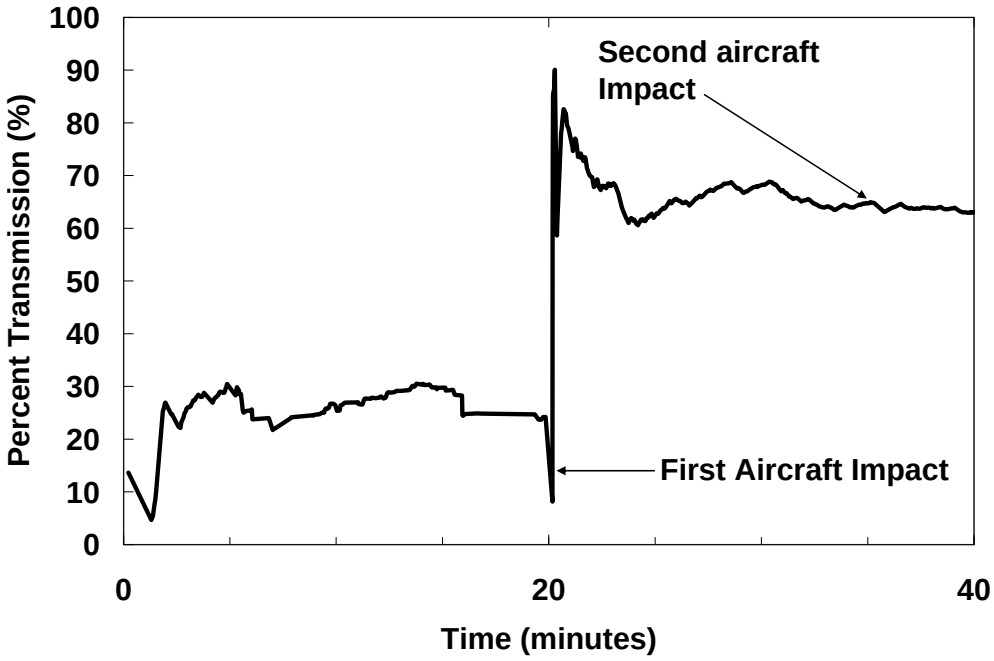


Figure 7–9. NYPD Division 1 channel plot of percent transmission versus time.

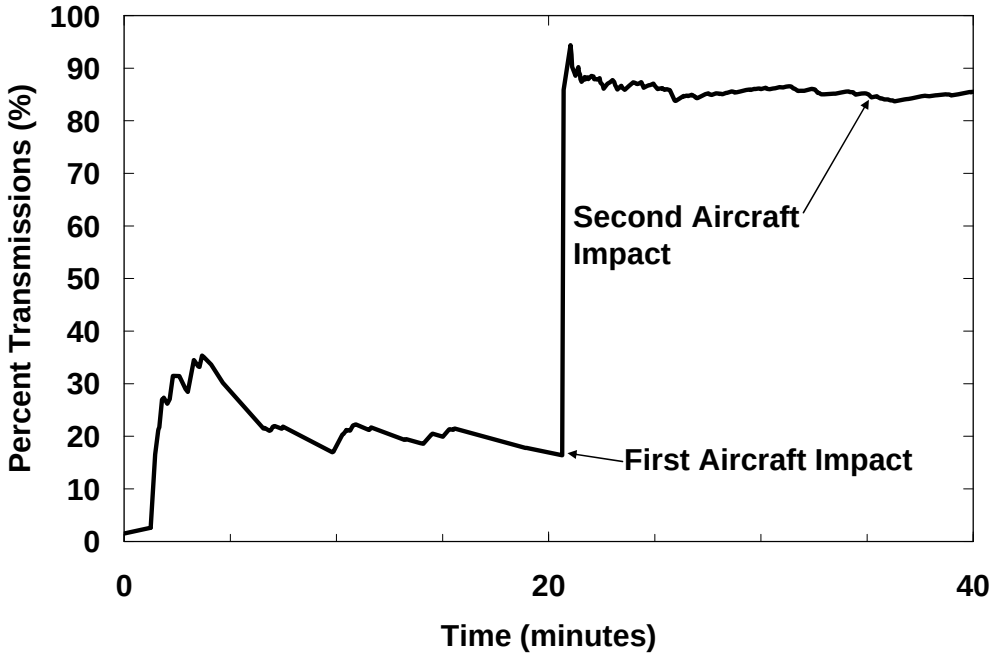


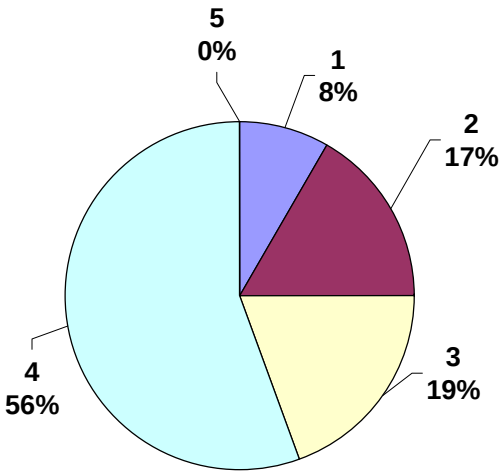
Figure 7–10. NYPD Special Operations Division channel plot of percent transmission versus time.

7.5 RADIO COMMUNICATIONS READABILITY ANALYSIS

As each of the communications files was transcribed, a readability value was assigned for each attempt to communicate. Results of this analysis are shown in Figure 7–11 through Figure 7–17. Analysis of these data showed that the ability to transmit a complete message was difficult during the communications surge. Data showed that approximately one-third to one-half of the radio communications for each of the three departments did not exceed a readability level of 2. These emergency communications were not complete and may have not been fully understood. The largest fraction of readability for all radio communications analyzed was recorded at a readability level of 3. This means that this fraction of communications was readable, but audio and radio transmission problems were being experienced. Some conditions that will cause poor communications quality are:

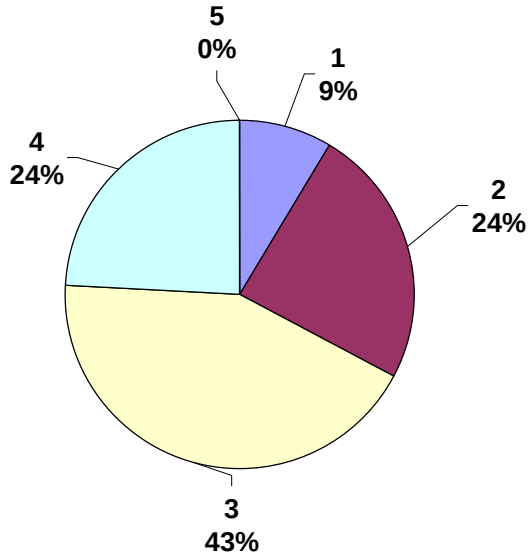
- Background noise either at the transmission point or receiving point or both,
- Operating health of transmitting and receiving radios and antenna systems,
- Doubling or crossing of radio signals caused by multiple transmissions at the same time on the same radio frequency, and
- Radio transmissions that may be affected by attenuating materials or electromagnetic interference.

In addition, approximately 25 percent of the radio communications had readability levels 4 or above. Typically, the higher readability levels were produced by the various department base stations that operate at a higher radio transmission output power than the hand held radios. However, there is one exception: several of the radio communications on the FDNY City-wide high-rise radio channel, the PAPD recording of Channel 30. It appears that the repeater was operating at the WTC site. Several of the radio communications on this channel were assigned readability values of four and five as the FDNY began its operations in WTC 2. In addition, some of these 4 and 5 readability value radio communications were occurring between FDNY personnel in the lobby of WTC 2 and FDNY personnel some 40 or more floors up inside the same building.



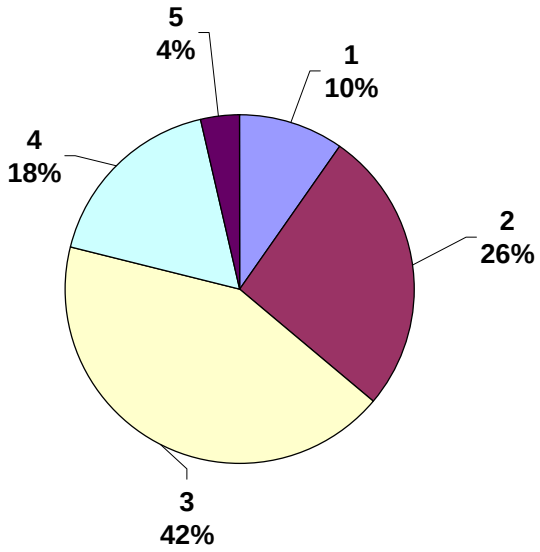
Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–11. PAPD Police Desk channel 26/W radio communications readability for the time period 20 minutes before first plane impact.



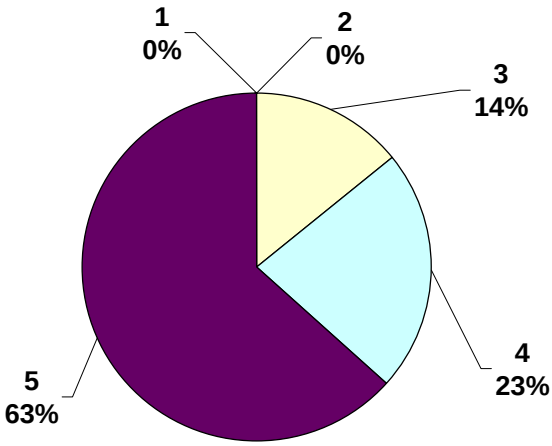
Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–12. PAPD Police Desk channel 26/W radio communications readability for time period 20 minutes after first plane impact.



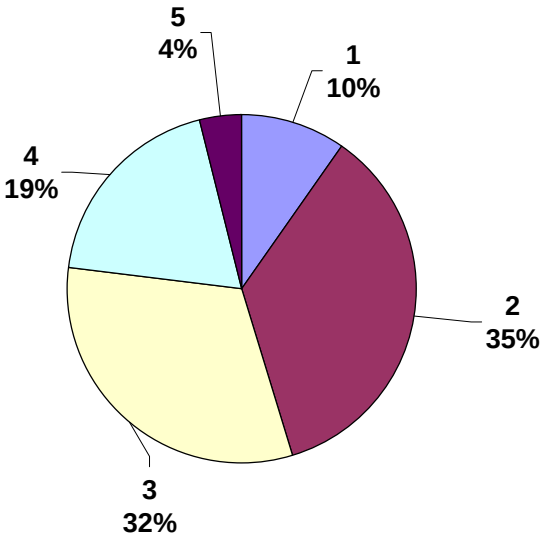
Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–13. FDNY City-Wide High-Rise channel 7 (PA/WTC Radio Channel 30) radio communications readability for time period 20 minutes after first plane impact.



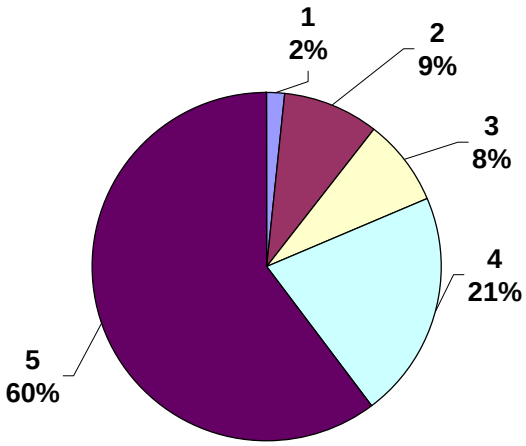
Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–14. NYPD Special Operations Division channel communications readability for time period 20 minutes before first plane impact.



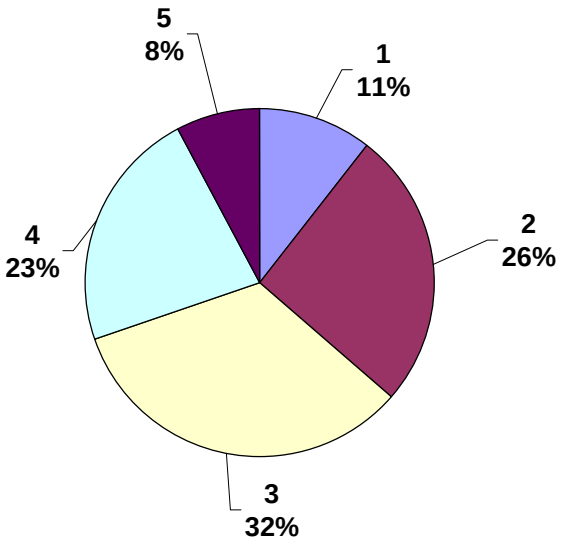
Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–15. NYPD Special Operations Division channel communications readability for time period 20 minutes after first plane impact.



Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4. – Readable with practically no difficulty
5. – Perfectly readable

Figure 7–16. NYPD Division 1 channel communications readability for time period 20 minutes before first plane impact.



Note: Readability scale:
1 – Unreadable
2 – Barely readable, occasional words distinguishable
3 – Readable with considerable difficulty
4 – Readable with practically no difficulty
5 – Perfectly readable

Figure 7–17. NYPD Division 1 channel communications readability for time period 20 minutes after first plane impact.

7.6 GENERAL COMMENTS ON RADIO COMMUNICATIONS

NIST's analysis of PA and NYPD radio systems indicated that they were working during the period of normal operations one half hour before the attack on the WTC. Also, the FDNY Manhattan Dispatch channel was functioning normally prior to the attack on the WTC. No other radio communications recordings relevant to the attack were available from FDNY. However, it was noted that Channel W of the PAPD was experiencing some difficulty with a handie-talkie radio transmitting a carrier wave as a result of an open or keyed microphone which disrupted communications on that channel. PAPD personnel recognized the problem and were busy trying to correct it just before the first plane struck WTC 1. The keyed microphone problem continued after the attack occurred. NYPD also had a problem with an open or keyed microphone after the attack began; it occurred on the Special Operations Division (SOD) channel. The problem was recognized and efforts were also made by the NYPD desk operator to get the problem cleared up. Initial attempts to correct the open microphone problem appeared to be successful.

Also, the data above for the various departments demonstrate the significant changes that occurred in radio communications traffic during the WTC operations. It is evident that PAPD, FDNY, and NYPD all experienced similar surges in radio traffic volume following the first aircraft impact into WTC 1. It is noteworthy that when the second aircraft struck WTC 2, 17 minutes later, there was no major surge in radio communications. This may be attributed to the fact that the initial emergency response assignments had already been made and that operations had already begun at the WTC, so an additional surge in radio communications was not needed. In addition, it is observed from the communications recordings and from first-person interviews that the emergency responders were trying to limit their use of the radios to reduce interference on their operating frequencies.

7.7 REFERENCES

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Fusco, A. L. 1993. *Unprecedented Complexity*, WNYF, 3rd, The Fire Department of the City of New York.

Palmer, Orio J. 1998. *Repeater Systems*, WNYF, 3rd, The Fire Department of the City of New York.

Chapter 8
COORDINATION OF RESPONSE ACTIVITIES WITH OTHER AGENCIES AT THE WORLD TRADE CENTER

The issue of coordination of emergency response activities among the different authorities (the New York City Fire Department [FDNY], the New York City Police Department [NYPD], The Port Authority Police Department [PAPD], and the New York City Office of Emergency Management [OEM]) at the World Trade Center (WTC) has implications for each of the emergency response departments. The attack on the WTC created a large and complex emergency response challenge for each responding organization. It is apparent that in general on the morning of September 11, 2001, all departments attempted to work together to save as many lives as possible and protect the citizens of New York City. It is also apparent that there were difficulties associated with inter-department operations. This is demonstrated by statements extracted from first-person interviews with NYPD Emergency Service Unit (ESU) officers and FDNY personnel.

The following statement describes interactions between NYPD ESU personnel and FDNY Rescue One personnel who were operating together up inside WTC 1 as they heard radio messages ordering the evacuation of the tower:

- The firefighters were contacting their command post as we were contacting ours. I asked the firefighter, did you hear the same thing and he said yes. The interviewee said we are getting out and the firefighter said yes. The firefighter from Rescue One that the interviewee was talking to perished that day. The interviewee thought that the firefighter was a hero. He kept all of the guys calm that were there. He also worked well with the interviewee in communicating back and forth what FDNY had and what NYPD ESU had. The interviewee told the firefighter that they would be exiting the building and the firefighter wanted to confirm that all NYPD ESU members were evacuating the building so he could inform his command post. The firefighter said that he was going to inform his guys and that they would be coming down right behind the ESU team.[1]

First-person interviews with FDNY and NYPD personnel also showed that at times some issues related to operational responsibility and the competitive nature of departments' did exist during the WTC operations. The following information was extracted from first-person emergency responder interviews:

- A team of ESU police officers went into WTC 1 and the fire department and Port Authority were there. They stopped at the FDNY Command Post. A Sergeant and a Lieutenant from the team approached the fire

[1] NYPD Interview 6, winter 2004.

> department to let them know they were there. The fire department did not acknowledge. There was no response. Since they got no response from the fire department they decided to go up the stairway to the upper floors.[2]

- A team of ESU police officers received instructions from an OEM staff member to report to the FDNY Lobby Command Post inside of WTC 2. The OEM member indicated that the ESU officers reluctantly followed his directions. The ESU team did report to the FDNY Command Post and they were given an assignment to assist a FDNY Chief many stories up in the building.[3]

The two interview statements above highlight issues related to departmental operational responsibility and the function of the operations command structure during the emergency response at the WTC. In general, emergency responder interviews suggest that inter-agency competition had minimal effect on operations at the WTC before the towers collapsed.

8.1 DEPARTMENT OPERATIONAL RESPONSIBILITY

The issue of which emergency responder department, police or fire, has command authority of a given operation has been a subject of discussion throughout the emergency response community for many years. In an attempt to reduce the uncertainty associated with this issue, the New York City Mayor's Office established an operations protocol. In April of 1994, FDNY and NYPD published a document entitled "Police/Fire Protocol."[4] The complete document is located in Appendix B. The introduction of this document stated that the protocol was "established to put and end to the confusion concerning the roles and responsibilities of the Police and Fire Departments at emergencies." In section 2.2 it states:

> "At the scene of a fire, the ranking Fire Department officer will assume command. The ranking member of the Police Department will report to the fire officer in charge and offer any assistance that may be required. The police supervisor will request the Fire Department commander to inform Fire Department subordinates that evidence, especially in suspected arson or explosive cases MUST be preserved and safeguarded."[4]

The following section, 2.3, stated that the Police Department would assume command at the scene of a non-fire emergency, and that the Fire Department would provide assistance for the Police Department as required. In addition to these two sections (that clearly specify the roles and responsibilities of the Police and Fire Departments at emergencies), section 2.5 addresses the protocol for how emergency responders would receive their directions and orders during an incident. This section stated the following:

> "During a joint operation, specific direction to members of both departments will be issued through their department's chain of

[2] FDNY Interview 5, winter 2004.

[3] FDNY Interview 54, winter 2004.

[4] New York City, *Police/Fire Protocol,* April 1994.

> command. Ranking police and fire commanders will confer frequently concerning orders and directions to be issued. The ranking officers of the Police and Fire Departments MUST be aware of the need for mutual cooperation. All police and fire personnel MUST understand that they will be held strictly accountable for their conduct during joint operations."[4]

The sections discussed above make it clear that FDNY was responsible for incident command at the WTC site since both of the WTC towers were on fire. As mentioned earlier, NYPD was in charge of aviation and roof operations since this was a criminal act. Relative to building collapse, section 3.4 of the protocol states that FDNY would be in command of rescue operations during a structural collapse. This issue saw intense debate by some personnel after the buildings collapsed and rescue operations were begun in the rubble field. Additionally from above, section 2.5 addressed the issue of how members of each department received directions during joint operations. Generally, this protocol was followed by the departments. FDNY was providing direction for its members and NYPD was providing direction for its members. This protocol potentially assisted in creating a conflict relative to operations inside the WTC towers. The protocol may have been associated with the response of FDNY Lobby Command Post personnel when NYPD personnel arrived, or it may also be associated with the reluctance of NYPD ESU personnel to report to the WTC 2 Lobby Command Post before going to work inside the tower. Also, section 2.5 indicated that ranking police and fire department commanders were to confer frequently concerning orders and directions to be issued. Information gathered related to the origination of unified orders and directions for FDNY and NYPD shows the process took place only at the department commissioner level. Evidence shows that FDNY and NYPD department chiefs were not working together at the same command post or that they formulated unified orders and directions for their departments. [5, 6]

8.2 OFFICE OF EMERGENCY MANAGEMENT AND MULTI-AGENCY OPERATIONS

The OEM was created in New York City after the 1993 bombing in part, to promote unified operations between and among the various city emergency responders. OEM was basically a support organization for expediting emergency response operations within the city. An analysis of the overall city emergency response structure indicates that New York City did not have a formalized Incident Command System that encompassed city wide emergency response operations. However, FDNY documents and first-person interviews show that FDNY was working under an established Incident Command System that was updated by the department in May of 1997.[7] A description of the Mayor's Office of Emergency Management (OEM) and its functions is provided in Appendix L.

On the morning of September 11, 2001, OEM operations were disrupted with the evacuation of the city's OEM operations center located inside WTC 7.[8] The FDNY Fire Commissioner stated the following

[5] NYPD Interview 12, winter 2004.
[6] FDNY Interview 65, spring 2004.
[7] FDNY Interviews 2, 7, and 20, winter 2004.
[8] FDNY Interview 45, winter 2004.

concerning the loss of the OEM center when he was turned away from WTC 7 shortly after it had been evacuated:

> "*How ridiculous*, I thought. *We've got a thirteen-million-dollar command center and we can't even use it.*" (Von Essen 2002)

Since the OEM center was not available for operations, NYPD, FDNY, and OEM Commissioners met the Mayor on the street with the group initially assembling at Barclay Street. At the same time, NYPD was establishing an alternate command center for the Mayor and his staff at 75 Barclay Street so that he and his staff could oversee operations. However, their operations from 75 Barclay Street were disrupted by the collapse of the towers, and they had to quickly evacuate from that site. Data show that there was no formal structure of unified command between departments below the Mayor and Commissioner level of operations. Also data indicates that FDNY and NYPD department chiefs were not working together at the same command post, and that they did not formulate unified orders and directions for their departments.

Unified command for the emergency response also was hampered by FDNY and NYPD setting up separate command posts for operations at the WTC. FDNY established its Incident Command Post (ICP) in the driveway of the parking garage at World Financial Center 2 (WFC 2), and there is no record that the ICP had any senior NYPD personnel assigned to it to provide liaison or assist with operations. One armed ESU team did provide a security sweep for the FDNY ICP, and it provided security for the ICP as operations were being established. However, NYPD set up its own separate command posts at Church and Vesey Streets and at West and Vesey Streets. It should be noted that the NYPD post at West and Vesey was only a short distance from the FDNY Incident Command Post at WFC 2. Figure 8–1 shows an armed NYPD ESU team member at the FDNY ICP location in front of WFC 2.

It is recognized that NYPD generally has different responsibilities from FDNY that relate to security, traffic control, protection of the public, and the crime scene. However, there were overlapping functions associated with ESU rescue team operations inside and around the WTC towers and FDNY operations. Although ESU rescue teams did eventually meet up with and work with FDNY personnel, functional unified operations were diminished as a result of the two departments' command posts being separated. It is also apparent from the emergency responder interviews that the separate command posts could not communicate with each other on their different radio systems. Additionally, neither department had liaison officers working with either the FDNY or NYPD command posts until after WTC 1 collapsed. With the collapse of the towers, a FDNY Chief was assigned to work at the newly establish command center at One Police Plaza.

The following information is extracted from FDNY Circular, A.U.C. 319, Office of Emergency Management, April 1996.[9]

[9] FDNY Circular, A.U.C. 319, Office of Emergency Management, April 1996.

Figure 8–1. Video image of an NYPD Emergency Service Unit member providing security at the FDNY Incident Command Post in front of WFC 2.

Purpose of the Mayor's Office of Emergency Management (OEM):

- Emergency management requires inter-agency and inter-governmental coordination as well as communication with the public and the press. The performance of these functions by the City is best coordinated by the Office of the Mayor. The Mayor's Office of Emergency Management has been established for this purpose.

Relevant Functions of OEM:

- Coordinate the City's response to all emergency conditions and potential incidents which require a multi-agency response, including but not limited to severe weather, threats from natural hazards and natural disasters, power and other public service outages, labor unrest other than the keeping of the peace, water main breaks, transportation and transit incidents, hazardous substance discharges, building collapses, and acts of terrorism.

- Monitor all potential emergency conditions and potential incidents which may require a multi- agency response.

- Coordinate and implement training programs, including emergency response drills, to prepare for emergency conditions and potential incidents which may require a multi-agency response.

- Increase public awareness as to the appropriate responses by members of the public to emergency conditions and potential incidents, and review the City's systems for disseminating information to the public.

- Operate and emergency operations center to assist the City in managing emergency conditions and potential incidents which may require a multi-agency response.

- Coordinate with the Police Department to ensure that the City agencies develop and implement emergency response plans in connection with planning for major City events.

- Coordinate with state, federal and other governmental bodies to effectuate the purposes of OEM.

On September 11, 2001, the OEM Operations Center located inside WTC 7 on the 23rd floor was disrupted when the building underwent an emergency evacuation after the second hijacked aircraft struck WTC 2. As a result, this center became unusable and the operations of the OEM office became less than totally effective until after WTC 1 and 2 collapsed. This loss of OEM operations had a negative impact on interagency operations during WTC operations. As the Mayor learned of OEM's evacuation, he immediately devised two priorities: 1) set up a new OEM Command Center, and 2) find a way to communicate with the people of New York City (Giuliani 2002). The following concerning unified emergency operations for the WTC event was extracted from the book by Mayor Giuliani:

- It was felt that this attack on the World Trade Center placed the city "*in uncharted waters*" and it was also felt that they would have to make up their response to the attack.

- It was also reported by the Mayor that early in the emergency operations a decision was made to establish two command posts: one for the Fire Department and one for the Police Department.

  It was stated that two different command posts were needed because the departments were going to perform different tasks and had different requirements. The following direct quotes are from Mayor Giuliani's book:

  > "The Fire Department had to lead the rescue and evacuation. The Police Department had to protect the rest of the city. As the team leading the rescue, the Fire Department immediately became the incident commander. They set up their command post so that they had the buildings in their line of sight. The Police Department had already begun setting up at 75 Barclay.
  >
  > Had the Police Department established its command post on West Street with the Fire Department, it would have been impossible for them to access the hardlines and necessary communications for the defense of the city. Had the Fire Department put its command post with the Police Department at 75 Barclay, it would have been impossible to observe the buildings and fight the fire. It was absolutely necessary to have two command posts – one to observe the fire and the other to permit communication via hardline. Having the police commissioner, the fire commissioner and Director of OEM together with me ensured

> coordination of the emergency rescue recovery and provided for the security of both the site and the city."

The different standard operating procedures of the agencies address cooperation between departments. However, the agencies have found it difficult in practice to operate under command of another group. This is especially true during large complex incidents.

The coordination of communications and operations between the responding authorities at the WTC was a challenge for all emergency responders working that morning. The short time frame related to the attack and emergency responder operations coupled with successive significant threats (an aircraft hitting WTC 2 after WTC 1 was hit, the threat of a third aircraft coming in, the collapse of WTC 2, etc.) that had to be responded too by the different agencies compounded the difficulty for establishing a unified operation. The challenges related to the establishment of unified operations were made significantly worse when the OEM facility located inside WTC 7 had to be evacuated. Although there was merit to having the FDNY and NYPD Command Posts separated related to the different types of operations, there was no uniform means for communicating between the two Command Posts by the time that WTC 2 collapsed. FDNY and NYPD were primarily operating as independent organizations based on their operational responsibilities. Consequently, functional unified operations were diminished as a result of the two department's command posts being separated, coupled with their inability to directly communicate with each other. It has been demonstrated in earlier parts of this report, however, that FDNY, EMS, NYPD, PAPD, PANYNJ, and OEM were attempting to work together at the WTC complex.

8.3 REFERENCES

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Von Essen, Thomas. 2002. Strong of Heart Life and Death in the Fire Department of New York, Regan Books, Harper Collins Publishers, New York.

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Chapter 9
FINDINGS

The emergency response to the World Trade Center (WTC) was complex and of unprecedented scale. Although New York's emergency responders had never experienced an operation of the size presented by the attack on the WTC, National Institute of Standards and Technology (NIST) has determined that they typically followed their department policies and procedures for the operations they were required to carry out. The WTC attack and its results presented unprecedented challenges to emergency responder practices and equipment. The following addresses the findings of this investigation.

9.1 ACCESS AND FIREFIGHTING

Building Access and Evacuation

The ability of occupants to evacuate from a building and the ability of emergency responders to access a building is largely a function of the building's design. During the attack on the WTC, the elevators and stairways were the primary means for moving through and out of the buildings. The following findings highlight the conditions and difficulties related to these building components:

- It was reported to the FDNY Battalion Chief who established the WTC 1 Lobby Command Post that the elevators were not working and/or were not generally safe for use during the WTC operations; however one elevator was used briefly by FDNY.

- People were trapped inside many of the elevators.

- Firefighters had to gain access to the injured and trapped occupants by climbing the stairs and carrying the equipment needed up the stairs.

- FDNY command personnel learned from 9-1-1 dispatch operators that smoke, fire, and structural damage in the buildings prevented many building occupants from evacuating floors above the impact zones.

- Mobility impaired individuals blocked stairway evacuation routes in WTC 1, and approximately 40 to 60 of these individuals were temporarily placed on the 12th floor to clear the stairways so others could evacuate.

- It is estimated that emergency responder climbing rates varied between approximately 1.4 minutes per floor for personnel not carrying extra equipment to approximately 2.0 minutes per floor for personnel wearing protective clothing and carrying extra equipment.

- Communications records and interviews indicate that smoke and heat conditions on the top of the two WTC buildings prevented the NYPD helicopters from conducting safe roof evacuation operations.

- NYPD aviation unit personnel reported critical information about degrading building conditions before WTC 2 collapsed and critical information about the impending collapse of the WTC 1 several minutes prior to its collapse. No evidence has been found to suggest that the information was further communicated to all emergency responders at the scene.

Emergency Response Operations

The magnitude of the attack and the results were far greater that anything that the city's emergency responders had ever experienced. The facts below provide a brief summary of emergency response operations that were critical to how operations were carried out before the collapse of WTC 2:

- A review of procedures and policies compared to the actions taken by FDNY at the WTC shows that the procedures and policies were being followed to a great extent at the WTC.

- The initial fire department size-up of the event was that a large aircraft had hit WTC 1, and that large fires were burning on multiple floors at and above the impact zone.

- It was likely that the water supply on the upper floors was damaged and that firefighting would not be an option until a reliable water supply was established and equipment was carried up.

- It appeared that the sprinkler and standpipe systems were compromised at the impact zone.

- FDNY command personnel knew that jet fuel had flowed into the elevator shafts and into other parts of the buildings and presented a danger to building occupants and emergency responder personnel.

- The known extent of the impact damage, fires in the buildings, and the height of the impact zones indicated that many of the people trapped above the impact zones were already dead or would likely die before emergency responders could reach them,

- The impact zones were located at heights in the buildings that would require hours for the emergency responders to accumulate appropriate equipment and personnel to carry out the large scale operations needed to successfully access the upper floors,

- Structural damage and fires caused by the aircraft impact would likely result in localized collapses in and above the impact and fire zones.

- The fact that the impact zone and fires were so high in the building and that the building's water supply was compromised brought the fire chiefs that established the original Command Post inside the lobby of WTC 1 to the conclusion that fire department efforts should be directed toward evacuation and rescue of building occupants.

- At the point when WTC 2 collapsed, WTC personnel had not yet accomplished tasks required for operating the building's fire pump systems, and WTC personnel had not given orders for starting the building's fire pump system.

- The consequence of firefighters and other emergency responders having to climb many tens of floors to get to a fire in a high-rise building can be summarized as follows:
  - The climbing rate is approximately one to two minutes per floor for emergency responders attempting to access a fire zone 30 floors or more high.
  - The ability to get both personnel and needed equipment to the desired location becomes limited by building height.
  - The time factors related to fire growth, the ability to rescue building occupants, and the ability to bring a fire under control becomes more critical with every additional floor in building height.
  - The ability of emergency responders to climb the stairs with equipment and remain physically fit to conduct rescue and firefighting operations is diminished with every additional floor in building height that must be climbed.
- The private ambulances or EMS teams that responded to the WTC had no equipment and no protective clothing at all. They also did not have the same radios so it was not possible to communicate with them by radio.

9.2 EMERGENCY RESPONDER EQUIPMENT

Generally, the equipment used by the emergency responders was adequate for the operations being carried out. However, there are some points related to equipment that need consideration.

For high-rise buildings, fire departments should work with building owners to establish caches of equipment that can be assessed at different locations inside the buildings. Firefighters should not be expected to carry heavy equipment up dozens of flights of stairs. Firefighters and other emergency responders who are forced to climb stairs to access a fire or other emergency should not have to wear or carry equipment that can be secured and maintained on the upper floors of high-rise buildings. Within the agreements developed between emergency responders and high-rise building owners, there should be a means for the emergency responder agencies to insure that the pre-positioned equipment is adequately inspected, maintained, and certified ready for use.

Equipment That Facilitated Operations

The emergency responder first-person interviews did highlight three pieces of equipment that made a difference in their operations that day; in fact, they are credited with saving the lives of many emergency responders. These items were: radios, flashlights, and SCBA's (Self Contained Breathing Apparatus).

Radios

Chapter 7 discussed the significant problems reported with the use of handie-talkie radios during the WTC operations on September 11, 2001. However, it is shown that numerous emergency responders felt

that their radios played a critical role in saving their lives. As seen in section 5.8.2, this viewpoint was expressed by personnel from each of the emergency responder departments.

Flashlights

A second piece of equipment credited with assisting operations and saving lives was the flashlight. Although the WTC attack took place on a clear and sunny day, flashlights became critical to emergency responders and occupants at the WTC complex when electrical power was lost and when the towers collapsed. Flashlights provided the light needed to evacuate from dark, smoky, and dust filled environments. (Section 5.8.2)

Breathing Apparatus (SCBA)

The third piece of equipment given high marks by emergency responders was the air-pack or SCBA. Numerous emergency responders indicated that they used their SCBAs to breathe after the WTC towers fell. The air was thick with debris, dust, and smoke and everyone found it difficult to breathe. Personnel with SCBAs were able to place the mask over their face and breathe fresh air from the air bottle even through the outside air was thick with dust and smoke. Many of the emergency responders with SCBAs shared their air supply with others around them. (Section 5.8.2)

9.3 EMERGENCY COMMUNICATIONS

Building Emergency Communications

- It was found through building occupant and emergency responder interviews that the emergency communications system used to make the emergency announcements inside WTC 1 was inoperable as a result of the aircraft impact.

- It also was learned by FDNY personnel up inside of WTC 1 that the warden phone system was damaged and the standpipe phone system was not operating.

Emergency Responder Radio Communications

- After the first aircraft struck the WTC, there was a peak increase in emergency responder radio communications by approximately a factor of 5, followed by an approximate factor of 3 steady level of radio communications.

- Analysis of the radio traffic for each of the departments shows periods where radio traffic rates during the surge conditions potentially resulted in situations where base station radio operators were unable to relay important information.

- During the surge in emergency responder radio traffic that occurred as a result of the attack on the WTC, approximately 1/3 to 1/2 of the emergency radio communications were not complete messages nor understandable.

- For the number of people at the WTC, the FDNY radio system was inadequate for locating and tracking personnel.

Repeater

- Radio communications recordings from the Port Authority radio communications system for their channel 30, which was the same as the FDNY channel 7 high-rise repeater channel, demonstrates that the FDNY high-rise repeater was operating.

- Some of the 4 and 5 readability value radio communications occurred between FDNY personnel in the lobby of WTC 2 and FDNY personnel some 40 or more floors up inside the same building.

9.4 COMMAND AND CONTROL

Even though the footprint of the WTC was small compared to the large areas that can be destroyed by earthquakes, hurricanes, tornados, wildfires, and urban conflagrations, the height and size of the buildings, the concentration of large numbers of occupants, and the large number of emergency responders needed to conduct operations created significant difficulties for emergency responder command and control. The vertical volume associated with the towers and the effects of tall building design and construction had an overall negative influence on emergency operations: firefighting, evacuation, rescue, and communications. The following addresses the findings associated with emergency responder command and control during these attacks.

- A FDNY interviewee indicated that on September 11, 2001, the Command Board approach to managing operations at the WTC became overwhelmed with the number of units and personnel reporting in for operations. In addition, an interviewee indicated that not all personnel that arrived at the WTC site were logged in on the Command Board. This is partially due to the size and complexity of operations at the WTC, but it also relates to personnel not always following department policies on reporting to the Command Post for assignment.

- FDNY had established a functional Incident Command System when WTC 2 collapsed, and FDNY had the human and equipment resources committed for conducting high-rise operations at the WTC.

- The FDNY Incident Command System was hampered by the loss of the OEM Command Center, the lack of a fully functional Field Comm unit, poor radio communications, and limited access to shared information critical to operations.

- The collapse of WTC 2 not only caused the death of numerous citizens and emergency responders but it totally disrupted the ongoing Incident Command System Operations being carried out by FDNY, NYPD, and PAPD.

Command Posts

The emergency responder operations associated with the WTC attack exhibited a situation where almost all emergency responder departments established their command posts within the potential collapse zone of the buildings. This approach had been a standard operating procedure for years since there had been no prior history of collapsing high-rise buildings. However, on September 11, 2001, it suddenly became apparent to all Command Post personnel that the posts were located too close to the buildings.

Personnel Accountability and Tracking

With any large emergency response, personnel accountability and tracking are vital part of command and control.

- In general, responding FDNY units to the WTC followed good practices as related to accountability. However, there were some cases where individuals did not report to the Command Post and became freelancers. Interviews with FDNY personnel showed that some fire department personnel came to WTC facilities without unit approval. In addition, there were various emergency responders from NYPD and PAPD that entered the towers without reporting into the FDNY Command Posts.

- Several obstacles with regard to accountability of EMS personnel added to operations difficulties. They were first, the size of the event as it unfolded and the difficulty that EMS Chiefs had in determining who was at the scene. Second, "self dispatch" and "freelancing" of some non FDNY ambulances. Finally, there was an inability of FDNY EMS supervisors to communicate with some of the non FDNY ambulances.

- Within the individual triage and treatment areas that were set up by EMS, it appears that efforts were made to keep track of patients. This was done with pencil and paper. All the data on patients were lost when the buildings collapsed. The loss of WTC 7 which housed the OEM hampered the ability to track patients within the system.

- Because of the self dispatch of non 9-1-1 resources, there were patients being removed from the location by those units and the EMS officers did not have any knowledge or records of these patients, or even knew if or where they had been transported.

- Once responders reported to a Command Post at the WTC, received their assignments, and departed to accomplish their tasks, there was no positive means to locate or track the activities of the units or individuals.

Communications and Information Sharing

All three of the emergency responder departments, FDNY, NYPD, and PAPD experienced difficulties with radio communications during the attack that occurred on the WTC. Each of the different departments was well aware of the shortfalls of their radio communications systems as it related to operations in the city and in high-rise building operations. They all knew not to expect perfect radio communications. There were two basic issues related to the quality of radio communications on September 11, 2001. One was the function of the radio equipment in the manor that it was being used

during the high-rise operations, and the other was the volume of radio traffic. For NYPD and PAPD, radio equipment did not appear to be a major problem during the operations.

Within the WTC site, the PAPD maintained a reasonable quality of radio communications as it related to the capabilities of the radio and antenna systems in the buildings and site. The Port Authority had added an extensive radio antenna system for Port Authority and PAPD operations at the site, and it worked well until WTC 2 collapsed. With the collapse of WTC 2, the abandonment of the Police Desk at WTC 5, and the PAPD repeater being lost, personnel were forced to switch to point-to-point communications.

NYPD also experienced successful operations with its radio equipment during communications at the WTC site. This may be attributed to the fact that only a small number of NYPD personnel entered and operated inside the WTC towers and that the mobilizations points for the NYPD personnel were located outside of the WTC towers (roughly a city block or more away from the towers). This location provided an unobstructed line of sight route for radio signals to travel to and from the towers allowing the radio signals to enter and exit the building's windows. The radio signals did not have to pass through floors of steel or steel-reinforced concrete.

It was well known by FDNY that handie-talkie radios did not work well in high-rise buildings that contain large amounts of metal and steel reinforced concrete. FDNY made attempts to overcome this challenge by developing the Battalion Car Cross-Band Repeater, and working with building owners to have building/complex repeaters put into areas where poor radio communications existed. FDNY also was attempting to improve the radio communications shortfall by the purchase of new handie-talkies. Even with all of this effort, FDNY radio communications suffered. One of the main contributing factors to poor FDNY communications at the WTC was that its primary Command Posts for conducting operations inside the buildings were located inside the lobby of each of the towers. This arrangement put the Chiefs managing operations inside the buildings at a location where radio signals would be attenuated by the building's structure and did not allow a clear path for radio signals from the lobby to propagate up through the building. This arrangement also blocked radio signals coming down to the lobby from upstairs. A solution to this problem was the use of the WTC/FDNY high-rise building repeater or the use of the Battalion Car Cross-band Repeater. Since the WTC/FDNY high-rise repeater appeared to have a communications handset malfunction and it was not understood, that repeater became ineffective in WTC 1. However, the WTC/FDNY high-rise repeater was apparently used by personnel inside WTC 2. The radio transmission record indicated that the Battalion Car Cross-band Repeater was taken over to the lobby of WTC 2. Only one radio message from the Battalion Chief who activated the cross-band repeater provides evidence that it was being used as a backup to the WTC site repeater. No other record has been located concerning the use of that repeater at the WTC. Also, the rules for using a Battalion Car Cross-band Repeater states that only one of these repeaters can be use at a time at one incident. With this, WTC 1 was apparently left without any capability of getting a radio signal outside of the building so that it could be retransmitted up with a clear propagation path. Therefore, radio communications to personnel working inside WTC 1 were seriously limited.

The lack of information sharing that resulted from poor radio and telephone communications, and the information overload conditions resulted in serious operational difficulties. Emergency responder communications systems are the critical link for command and control and personnel safety. The incoming data and other information were not being pooled and analyzed in real time during operations, were not being distributed to all emergency responders who needed it; and were not being delivered to

emergency personnel and the public (WTC occupants) in a timely fashion. As a result, many emergency responders were not getting the critical information they needed for conducting operations and for maintaining the safety of their personnel. This had a significant impact on many of the emergency responders' attempts to maintain good *situational awareness.* In addition, some occupants inside the WTC were not getting information that potentially could have saved their lives. An example is that there was one staircase inside WTC 2 that was passable for a period of time to the area above the impact zone. Information on this escape route was not acquired from the evacuating occupants and not passed on to others trapped above the impact zone. The gathering, analysis, and distribution of critical emergency information by responders and government agencies not only affect them and their operations but also affect citizens at the scene and citizens within the community where a large emergency occurs.

There was a large amount of critical data gathered and transmitted through the various communications routes during the approximate two hours following the first aircraft impact. It has been learned that a sizable fraction of this information was either not acted upon or was not transmitted to all appropriate parties. As a result, the emergency responder's information matrix was left with holes where these critical data should have been available for decision making and promoting safe operations. An example of this is where a senior level PAPD officer - with the authority to call for a total evacuation - immediately called for the evacuation of WTC 1 just after it was hit and again called for the evacuation of the entire complex before the WTC 2 building was hit. There is no record of any action being taken related to these instructions. These communications are found in the Evacuation Chronology section of this document.

Finally, a preponderance of evidence indicates that emergency responder lives were likely lost at the WTC resulting from the lack of timely information sharing and inadequate communications capabilities.

Emergency Responder Evacuation of the WTC

- Radio communications associated with the order to evacuate WTC 1 had mixed results. Data shows that different personnel located on the same floors of the building either heard the evacuation orders or did not hear the orders.

- Based on emergency responder interviews approximately one half of the personnel located up inside WTC 1 heard radio messages calling for the immediate evacuation of the building.

- Individuals who had the evacuation information were actively telling others that the building was being evacuated.

Emergency Responder/News Media Communications

- Emergency responder/news media communications were less than totally effective during the WTC operations on the morning of September 11, 2001.

- Critical information related to life safety and evacuation from the WTC towers was not communicated to the news media so that it could be broadcast to people trapped inside the WTC towers above the building fires.

- Some news media contacts with emergency responder agencies interfered with the emergency response and life saving operations. Appropriate emergency response agency contact points were bypassed or not used by some news media for gathering information.

- It appears that emergency response agencies were overwhelmed by news media requests for information.

Inter-agency Operations and Unified Command

During the WTC operations, there were many cases where FDNY, NYPD, and PAPD worked together to provide aid or to rescue people. There were cases where personnel from one agency needed to report to the Command Post of a different agency and get a job assignment. At times, fire or police departments may be compelled to conduct operations that can be dangerous to other emergency responders. In this event the locations of all emergency responders must be known at the event and all emergency responders must receive timely information from a unified command in order to maintain their safety.

- It is apparent that in general on the morning of September 11, 2001, all departments attempted to work together to save as many lives as possible and protect the citizens of New York City.

- On the morning of September 11, 2001, OEM operations were disrupted with the loss of the city's OEM operations center that was located inside WTC 7.

- There was no formal structure of unified command between departments below the Commissioner level of operations.

- Data indicate that FDNY and NYPD department chiefs were not working together at the same command post, and that they did not formulate unified orders and directions for their departments.

- Functional unified operations were diminished as a result of the FDNY and NYPD department command posts being separated. Emergency responder interviews show that the separate command posts could not directly communicate with each other using their handie-talkie radios.

- There were overlapping functions associated with ESU rescue team operations inside and around the WTC towers and FDNY operations.

- Neither FDNY nor NYPD had liaison officers working with the other department's command post until after WTC 1 collapsed.

Many of the items listed above highlight areas where the WTC emergency response had difficulties. These items include command and control, command post locations, staging, assignments, personnel accountability, information overload, inter-agency operations, communications, information sharing, situational awareness, and equipment for operations in high-rise buildings. Most of these areas of concern are associated with emergency response operations that occur daily throughout the United States. It points out the importance of emergency responders and governments having the capability to greatly

advance operations beyond the normal scale of business while maintaining the above items under control. Additionally, it is imperative that emergency responders and governments are prepared for high risk operations by planning, equipping, training, and testing of emergency response capabilities so that all will function effectively when they are needed.

Chapter 10
POST-SEPTEMBER 11, 2001, EFFORTS

Following the attack on the World Trade Center (WTC), New York City has actively analyzed the events of September 11, 2001. During the period following the attack up until present, the Fire Department of the City of New York (FDNY), the New York City Police Department (NYPD), and other city agencies have been making progress toward enhancing preparedness.[1, 2] The Office of Emergency Management has been reestablished and is operating. The city has developed new policies and procedures related to city-wide emergency operations. In addition, the city is studying the National Incident Management System (NIMS) as a potential means for operating a city-wide incident command system. FDNY has replaced all lost firefighting apparatus and has re-staffed the department to its pre-September 11th levels. Additionally, FDNY has concentrated on developing the following areas:

- training of firefighters related to complex operations,
- comprehensive training of personnel related to the Incident Command System (ICS),
- training of multiple teams as Incident Management Teams (IMT),
- increasing capabilities related to HazMat operations,
- helping to establish and participate in a City-wide Incident Management System (CIMS),
- developing an updated Strategic Plan for the department,
- developing an improved communications system incorporating new radio technologies with a focus on interoperability with other agencies they would be expected to work with,
- establishing an intelligence sharing and needs effort with other agencies,
- establishing a new Fire Department Operations Center,
- developing an advanced Electronic Command Board for incident command operations,
- developing specific emergency response plans that take into account updated practices on recall, staging, and multi-agency operations,
- conducting internal and multi-agency drills and exercises to train personnel,
- ongoing preparedness planning effort to deal with new threats and long-term challenges, and

[1] The Fire Department of the City of New York, Written Statement of the FDNY Before the National Institute of Standards and Technology, November 22, 2004.

[2] The City of New York Law Department, written communication, August 4, 2005.

- as related to prevention, FDNY has also been working on the revision of the building code and fire codes in New York City.

The above efforts represent some of the areas where FDNY identified needs related to their capabilities as they addressed the lessons learned following the September 11, 2001, attack on the WTC. Many of these efforts are ongoing and will take commitment, time, and funds to complete. FDNY is making progress with their efforts. However, it is noted that many of the areas addressed above also reflect on the needs of other fire departments and emergency responders located across the United States. Serious efforts are needed to insure that our nation's emergency responders are ready to safely operate at unexpected and complex events where large numbers of personnel are needed and where multi-agency operations are required for saving lives and minimizing the impact of the incident.

Attachment 1
EMERGENCY RESPONDER LIST OF FATALITIES AND MISSING

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Angello, Joseph	Firefighter	Ladder 118
Ahearn, Brian	Lieutenant	Engine 230
Allen, Eric	Firefighter	Squad 18
Allen, Richard	Firefighter	Ladder 15
Amato, James	Captain	Squad 1
Anaya, Jr., Calixto	Firefighter	Engine 4
Angelini, Joseph	Firefighter	Rescue 1
Angelini, Jr., Joseph	Firefighter	Ladder 4
Apostol, Jr., Faustino	Firefighter	Battalion 2
Arce, David	Firefighter	Engine 33
Arena, Louis	Firefighter	Ladder 5
Asaro, Carl	Firefighter	Battalion 9
Atlas, Gregg	Lieutenant	Engine 10
Atwood, Gerald	Firefighter	Ladder 21
Baptiste, Gerard	Firefighter	Ladder 9
Barbara, Gerard	Assistant Chief	City Wide Tour
Barnes, Matthew	Firefighter	Ladder 25
Barry, Arthur	Firefighter	Ladder 15
Bates, Steven	Lieutenant	Engine 235
Bedigian, Carl	Lieutenant	Engine 214
Belson, Stephen	Firefighter	Ladder 24
Bergin, John	Firefighter	Rescue 5
Beyer, Paul	Firefighter	Engine 6
Biefeld, Peter	Firefighter	Ladder 42
Bilcher, Brian	Firefighter	Squad 1
Bini, Carl	Firefighter	Rescue 5
Blackwell, Christopher	Firefighter	Rescue 3
Bocchino, Michael	Firefighter	Battalion 48
Bonomo, Frank	Firefighter	Engine 230
Box, Gary	Firefighter	Squad 1

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Boyle, Michael	Firefighter	Engine 33
Bracken, Kevin	Firefighter	Engine 40
Breman, Michael	Firefighter	Ladder 4
Brennan, Peter	Firefighter	Rescue 4
Brethel, Daniel	Captain	Ladder 24
Brown, Patrick	Captain	Ladder 3
Brunn, Andrew	Firefighter	Ladder 5
Brunton, Vincent	Captain	Ladder 105
Bucca, Ronald	Fire Marshal	
Buck, Greg	Firefighter	Engine 201
Burke, Jr., William	Captain	Engine 21
Burns, Donald	Assistant Chief	City Wide Tour
Burnside, John	Firefighter	Ladder 20
Butler, Thomas	Firefighter	Squad 1
Byrne, Patrick	Firefighter	Ladder 101
Cain, George	Firefighter	Ladder 7
Calabro, Salvatore	Firefighter	Ladder 101
Callahan, Frank	Captain	Ladder 35
Cammarata, Michael	Firefighter	Ladder 11
Cannizzaro, Brian	Firefighter	Ladder 101
Carey, Dennis	Firefighter	Haz-Mat Co. 1
Carlo, Michael	Firefighter	Engine 230
Carroll, Michael	Firefighter	Ladder 3
Carroll, Peter	Firefighter	Squad 1
Casoria, Thomas	Firefighter	Engine 22
Cawley, Michael	Firefighter	Ladder 136
Cherry, Vernon	Firefighter	Ladder 118
Chiofalo, Nicholas	Firefighter	Engine 235
Chipura, John	Firefighter	Engine 219
Clarke, Michael	Firefighter	Ladder 2
Coakley, Steven	Firefighter	Engine 217
Coleman, Tarel	Firefighter	Squad 252
Collins, John	Firefighter	Ladder 25
Cordice, Robert	Firefighter	Squad 1
Correa, Ruben	Firefighter	Engine 74
Corrigan, James	Captain	Engine 320
Coyle, James	Firefighter	Ladder 3

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Crawford, Robert	Firefighter	Safety Battalion 1
Crisci, John	Lieutenant	Haz-Mat Co. 1
Cross, Dennis	Battalion Chief	Battalion 57
Cullen, III, Thomas	Firefighter	Squad 41
Curatolo, Robert	Firefighter	Ladder 16
D'Auria, Michael	Firefighter	Engine 40
Datri, Edward	Lieutenant	Squad 1
Davidson, Scott	Firefighter	Ladder 118
Day, Edward	Firefighter	Ladder 11
DeRubbio, David	Firefighter	Engine 226
Deangelis, Thomas	Battalion Chief	Battalion 8
Delvalle, Manuel	Firefighter	Engine 5
Demeo, Martin	Firefighter	Haz-Mat Co. 1
Desperito, Andrew	Lieutenant	Engine 1
Devlin, Dennis	Battalion Chief	Battalion 9
Dewan, Gerard	Firefighter	Ladder 3
Dipasquale, George	Firefighter	Ladder 2
Donnelly, Kevin	Lieutenant	Ladder 3
Dowdell, Kevin	Lieutenant	Rescue 4
Downey, Raymond	Battalion Chief	Special Operations
Duffy, Gerard	Firefighter	Ladder 21
Egan, Jr., Martin	Captain	Division 15
Elferis, Michael	Firefighter	Engine 22
Esposito, Francis	Firefighter	Engine 235
Esposito, Michael	Lieutenant	Squad 1
Evans, Robert	Firefighter	Engine 33
Fanning, John	Battalion Chief	Haz-Mat Ops
Farino, Thomas	Captain	Engine 26
Farrell, Terrence	Firefighter	Rescue 4
Farrelly, Joseph	Captain	Division 1
Feehan, William	Chief	1st Deputy Comm.
Fehling, Lee	Firefighter	Engine 235
Feinberg, Alan	Firefighter	Battalion 9
Fiore, Michael	Firefighter	Rescue 5
Fischer, John	Captain	Ladder 20
Fletcher, Andre	Firefighter	Rescue 5
Florio, John	Firefighter	Engine 214

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Fodor, Michael	Lieutenant	Squad 1
Foley, Thomas	Firefighter	Rescue 3
Fontana, David	Firefighter	Squad 1
Foti, Robert	Firefighter	Ladder 7
Fredericks, Andrew	Firefighter	Squad 18
Freund, Peter	Lieutenant	Engine 55
Gambino, Jr., Thomas	Firefighter	Rescue 3
Ganci, Jr., Peter	Chief of Department	Chief of Department
Garbarini, Charles	Lieutenant	Battalion 9
Gardner, Thomas	Firefighter	Haz-Mat Co. 1
Garvey, Matthew	Firefighter	Squad 1
Gary, Bruce	Firefighter	Engine 40
Geidel, Gary	Firefighter	Rescue 1
Geraghty, Edward	Battalion Chief	Battalion 9
Germain, Denis	Firefighter	Ladder 2
Giammona, Vincent	Lieutenant	Ladder 5
Giberson, James	Firefighter	Ladder 35
Gies, Ronnie	Lieutenant	Squad 288
Gill, Paul	Firefighter	Engine 54
Ginley, John	Lieutenant	Engine 40
Giordano, Jeffrey	Firefighter	Ladder 3
Giordano, John	Firefighter	Engine 37
Glascoe, Keith	Firefighter	Ladder 21
Gray, James	Firefighter	Ladder 20
Grzelak, Joseph	Battalion Chief	Battalion 48
Guadalupe, Jose	Firefighter	Engine 54
Guja, Geoffrey	Lieutenant	Battalion 43
Gullickson, Joseph	Lieutenant	Ladder 101
Halderman, David	Firefighter	Squad 18
Halloran, Vincent	Lieutenant	Ladder 8
Hamilton, Robert	Firefighter	Squad 41
Hanley, Sean	Firefighter	Ladder 20
Hannafin, Thomas	Firefighter	Ladder 5
Hannon, Dana	Firefighter	Engine 26
Harlin, Daniel	Firefighter	Ladder 2
Harrell, Harvey	Lieutenant	Rescue 5
Harrell, Stephen	Lieutenant	Battalion 7

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Haskell, Jr., Thomas	Battalion Chief	Division 15
Haskell, Timothy	Firefighter	Squad 18
Hatton, Terence	Captain	Rescue 1
Haub, Michael	Firefighter	Ladder 4
Hayes, Philip	Firefighter	Engine 217
Healey, Michael	Lieutenant	Squad 41
Heffernan, John	Firefighter	Ladder 11
Henderson, Ronnie	Firefighter	Engine 279
Henry, Joseph	Firefighter	Ladder 21
Henry, William	Firefighter	Rescue 1
Hetzel, Thomas	Firefighter	Ladder 13
Hickey, Brian	Captain	Rescue 4
Higgins, Timothy	Lieutenant	Special Operations
Hohmann, Jonathon	Firefighter	Haz-Mat Co. 1
Holohan, Thomas	Firefighter	Engine 6
Hunter, Joseph	Firefighter	Squad 288
Hynes, Walter	Captain	Ladder 13
Ielpi, Jonathon	Firefighter	Squad 288
Ill, Jr., Frederick	Captain	Ladder 2
Johnston, William	Firefighter	Engine 6
Jordan, Andrew	Firefighter	Ladder 132
Joseph, Karl	Firefighter	Engine 207
Jovic, Anthony	Lieutenant	Battalion 47
Juarbe, Jr., Angel	Firefighter	Ladder 12
Judge, Mychal	Chaplain	Chaplain
Kane, Vincent	Firefighter	Engine 22
Kasper, Charles	Battalion Chief	SOC Battalion
Keating, Paul	Firefighter	Ladder 5
Kelly, Thomas	Firefighter	Ladder 105
Kelly, Thomas	Firefighter	Ladder 15
Kelly, Jr., Richard	Firefighter	Ladder 11
Kennedy, Thomas	Firefighter	Ladder 101
Kerwin, Ronald	Lieutenant	Squad 288
Kiefer, Michael	Firefighter	Ladder 132
King, Jr., Robert	Firefighter	Engine 33
Kopytko, Scott	Firefighter	Ladder 15
Krukowski, William	Firefighter	Ladder 21

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Kumpel, Kenneth	Firefighter	Ladder 25
Kuveikis, Thomas	Firefighter	Squad 252
Laforge, David	Firefighter	Ladder 20
Lake, William	Firefighter	Rescue 2
Lane, Robert	Firefighter	Engine 55
Langone, Peter	Firefighter	Squad 252
Larsen, Scott	Firefighter	Ladder 15
Leavey, Joseph	Lieutenant	Ladder 15
Leavy, Neil	Firefighter	Engine 217
Libretti, Daniel	Firefighter	Rescue 2
Lillo, Carlos	Paramedic	Battalion 49
Linnane, Robert	Firefighter	Ladder 20
Lynch, Michael	Firefighter	Engine 40
Lynch, Michael	Firefighter	Ladder 4
Lyons, Michael	Firefighter	Squad 41
Lyons, Patrick	Firefighter	Squad 252
Maffeo, Joseph	Firefighter	Ladder 101
Mahoney, William	Firefighter	Rescue 4
Maloney, Joseph	Firefighter	Ladder 3
Marchbanks, Jr., Joseph	Battalion Chief	Battalion 57
Margiotta, Charles	Lieutenant	Battalion 22
Marino, Kenneth	Firefighter	Rescue 1
Marshall, John	Firefighter	Ladder 27
Martin, Peter	Lieutenant	Rescue 2
Martini, Paul	Lieutenant	Engine 201
Mascali, Joseph	Firefighter	Tactical Support 2
Maynard, Keithroy	Firefighter	Engine 33
McAleese, Brian	Firefighter	Engine 226
McAvoy, John	Firefighter	Ladder 3
McCann, Thomas	Firefighter	Battalion 8
McGinn, William	Lieutenant	Squad 18
McGovern, William	Battalion Chief	Battalion 2
McHugh, Dennis	Firefighter	Ladder 13
McMahon, Robert	Firefighter	Ladder 20
McPadden, Robert	Firefighter	Engine 23
McShane, Terence	Firefighter	Ladder 101
McSweeney, Timothy	Firefighter	Ladder 3

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
McWilliams, Martin	Firefighter	Engine 22
Meisenheimer, Raymond	Firefighter	Rescue 3
Mendez, Charles	Firefighter	Ladder 7
Mercado, Steve	Firefighter	Engine 40
Miller, Douglas	Firefighter	Rescue 5
Miller, Jr., Henry	Firefighter	Ladder 105
Minara, Robert	Firefighter	Ladder 25
Mingione, Thomas	Firefighter	Ladder 132
Mitchell, Paul	Lieutenant	Battalion 1
Modafferi, Louis	Captain	Rescue 5
Mojica, Dennis	Lieutenant	Rescue 1
Mojica, Manuel	Firefighter	Squad 18
Molinaro, Carl	Firefighter	Ladder 2
Montesi, Michael	Firefighter	Rescue 1
Moody, Thomas	Captain	Division 1
Moran, John	Battalion Chief	Battalion 49
Morello, Vincent	Firefighter	Ladder 35
Mozzillo, Christopher	Firefighter	Engine 55
Muldowney, Jr., Richard	Firefighter	Ladder 7
Mullan, Michael	Firefighter	Ladder 12
Mulligan, Dennis	Firefighter	Ladder 2
Murphy, Raymond	Lieutenant	Ladder 16
Nagel, Robert	Lieutenant	Engine 58
Napolitano, John	Firefighter	Rescue 2
Nelson, Peter	Firefighter	Rescue 4
Nevins, Gerard	Firefighter	Rescue 1
Oberg, Dennis	Firefighter	Ladder 105
O'Callaghan, Daniel	Lieutenant	Ladder 4
Oelschlager, Douglas	Firefighter	Ladder 15
Ogren, Joseph	Firefighter	Ladder 3
O'Hagan, Thomas	Lieutenant	Battalion 4
O'Keefe, William	Captain	Division 15
O'Keefe, Patrick	Firefighter	Rescue 1
Oitice, Samuel	Firefighter	Ladder 4
Olsen, Eric	Firefighter	Ladder 15
Olsen, Jeffery	Firefighter	Engine 10
Olsen, Steven	Firefighter	Ladder 3

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
O'Rourke, Kevin	Firefighter	Rescue 2
Otten, Michael	Firefighter	Ladder 35
Palazzo, Jeffery	Firefighter	Rescue 5
Palmer, Orio	Battalion Chief	Battalion 7
Palombo, Frank	Firefighter	Ladder 105
Pansini, Paul	Firefighter	Engine 10
Paolillo, John	Battalion Chief	Battalion 11
Pappageorge, James	Firefighter	Engine 23
Parro, Robert	Firefighter	Engine 8
Pearsall, Durrell	Firefighter	Rescue 4
Perry, Gleen	Lieutenant	Ladder 25
Petti, Philip	Lieutenant	Battalion 7
Pfeifer, Kevin	Lieutenant	Engine 33
Phelan, Kenneth	Lieutenant	Engine 217
Pickford, Christopher	Firefighter	Engine 201
Powell, Shawn	Firefighter	Engine 207
Princiotta, Vincent	Firefighter	Ladder 7
Prior, Kevin	Firefighter	Squad 252
Prunty, Richard	Battalion Chief	Battalion 2
Quappe, Lincoln	Firefighter	Rescue 2
Quilty, Michael	Lieutenant	Ladder 11
Quinn, Ricardo	Paramedic	Battalion 57
Ragaglia, Leonard	Firefighter	Engine 54
Ragusa, Michael	Firefighter	Engine 279
Rall, Edward	Firefighter	Rescue 2
Rand, Adam	Firefighter	Squad 288
Regan, Donald	Firefighter	Rescue 3
Regan, Robert	Lieutenant	Ladder 118
Regenhard, Christian	Firefighter	Engine 279/Ladder 131
Reilly, Kevin	Firefighter	Engine 207
Richard, Vernon	Captain	Ladder 7
Riches, James	Firefighter	Engine 4
Rivelli, Jr., Joseph	Firefighter	Ladder 25
Roberts, Michael	Firefighter	Ladder 35
Roberts, Michael	Firefighter	Engine 214
Rodriguez, Anthony	Firefighter	Engine 279
Rogan, Matthew	Firefighter	Ladder 11

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Rossomando, Nicholas	Firefighter	Rescue 5
Rubach, Paul	Firefighter	Ladder 25
Russell, Stephen	Firefighter	Engine 55
Russo, Michael	Lieutenant	Special Operations
Ryan, Matthew	Battalion Chief	Battalion 1
Sabella, Thomas	Firefighter	Ladder 13
Santora, Christopher	Firefighter	Engine 54
Santore, John	Firefighter	Ladder 5
Saucedo, Gregory	Firefighter	Ladder 5
Scauso, Dennis	Firefighter	Haz-Mat Co. 1
Schardt, John	Firefighter	Engine 201
Scheffold, Fred	Battalion Chief	Battalion 12
Schoales, Thomas	Firefighter	Engine 4
Schrang, Gerard	Firefighter	Rescue 3
Sikorsky, Gregory	Firefighter	Squad 41
Siller, Stephen	Firefighter	Squad 1
Smagala, Jr., Stanley	Firefighter	Engine 226
Smith, Kevin	Firefighter	Haz-Mat Co. 1
Smith, Jr., Leon	Firefighter	Ladder 118
Spear, Jr., Robert	Firefighter	Engine 26
Spor, Joseph	Firefighter	Ladder 38
Stack, Lawrence	Battalion Chief	Battalion 50
Stackpole, Timothy	Captain	Division 11
Stajk, Gregory	Firefighter	Ladder 13
Stark, Jeffery	Firefighter	Engine 230
Suarez, Benjamin	Firefighter	Ladder 21
Suhr, Daniel	Firefighter	Engine 216
Sullivan, Christopher	Lieutenant	Ladder 111
Sweeney, Brian	Firefighter	Rescue 1
Tallon, Sean	Firefighter	Ladder 10
Tarasiewicz, Allan	Firefighter	Rescue 5
Tegtmeier, Paul	Firefighter	Engine 4
Tierney, John	Firefighter	Ladder 9
Tipping, II, John	Firefighter	Ladder 4
Tirado, Jr., Hector	Firefighter	Engine 23
VanHine, Richard	Firefighter	Squad 41
Vega, Peter	Firefighter	Ladder 118

Fire Department City of New York/Paramedics

List of Dead and Missing:

September 11, 2001

Name	Rank	Unit
Veling, Lawrence	Firefighter	Engine 235
Vigiano, II, John	Firefighter	Ladder 132
Villanueva, Sergio	Firefighter	Ladder 132
Virgilio, Lawrence	Firefighter	Squad 18
Wallace, Robert	Lieutenant	Engine 205
Walz, Jeffery	Firefighter	Ladder 9
Warchola, Michael	Lieutenant	Ladder 5
Waters, Partick	Captain	Special Operations
Watson, Kenneth	Firefighter	Engine 214
Weinberg, Michael	Firefighter	Engine 1
Weiss, David	Firefighter	Rescue 1
Welty, Timothy	Firefighter	Squad 288
Whelan, Eugene	Firefighter	Engine 230
White, Edward	Firefighter	Engine 230
Whitford, Mark	Firefighter	Engine 23
Wilkinson, Glenn	Lieutenant	Engine 238
Williamson, John	Battalion Chief	Battalion 6
Wooley, David	Captain	Ladder 4
Wren, William X.	Firefighter	Ladder 166
York, Raymond	Firefighter	Engine 285
Roma, Keith	Fire Patrolman	Fire Patrol 2, New York Board of Fire Underwriters

Other Fire/EMS, Emergency Responders

Fire Service

Lovero, Joseph	Fire Dispatcher	Jersey City, NJ

Paramedic/EMS

Fairben, Keith	Paramedic/Lieutenant	Hospital EMS, New York Presbyterian Hospital / Floral Park, NY Volunteer Fire Department
Hamdani, Mohammed S.	Ambulance Driver	Howard Hughs Medical Institute
Merino, Yamel J.	Paramedic/EMT	Hospital EMS, Metro Care Ambulance
Pearlman, Richard A.	Paramedic/EMT	Hospital EMS, Forest Hills Volunteer Ambulance Corp.
Santoro, Mario L.	Paramedic/EMT	Hospital EMS, New York Presbyterian Hospital
Schwartz, Mark	Paramedic/EMT	Hospital EMS, EMT 7981, Hunter Ambulance
Simpson, Jeff	Paramedic/EMT	Triangle Rescue Squad, Inc., Dumfries, VA
Sullins, David Marc	Paramedic/EMT	Hospital EMS, Cabrini Hospital
Winuk, Glenn J.	Firefighter	Volunteer Firefighter

New York City Police Department

List of Dead and Missing

Name	Rank	Unit/Command
Coughlin, John	Sergeant	ESU Truck 4
Curtin, Michael	Sergeant	ESU Truck 2
Gillis, Rodney	Sergeant	ESU Truck 8
Roy, Timothy	Sergeant	Bus Squad
Richards, Claude	Detective	Bomb Squad
Vigiano, Joseph	Detective	ESU Truck 2
D'Allara, John	Police Officer	ESU Truck 2
Danz, Vincent	Police Officer	ESU Truck 3
Dominguez, Jerome	Police Officer	ESU Truck 3
Driscoll, Stephen	Police Officer	ESU Truck 4
Ellis, Mark	Police Officer	Transit District 4
Fazio, Robert	Police Officer	13th Precinct
Kloepfer, Ronald	Police Officer	ESU Truck 7
Langone, Thomas	Police Officer	ESU Truck 10
Leahy, James	Police Officer	6th Precinct
McDonnell, Brian	Police Officer	ESU Truck 10
Perry, John	Police Officer	40th Precinct
Pettit, Glen	Police Officer	Police Academy
Smith, Moira	Police Officer	13th Precinct
Suarez, Ramon	Police Officer	Transit District 4
Talty, Paul	Police Officer	ESU Truck 10
Valentin, Santos	Police Officer	ESU Truck 7
Weaver, Walter	Police Officer	ESU Truck 3

Port Authority Police Department PAPD/PANYNJ

List of Dead and Missing

Name	Rank	Unit/Command
Morrone, Fred V.	Superintendent of Police	Headquarters Command
Romito, James A.	Chief of Police	Headquarters Command
Mazza, Kathy N.	Captain, CO	PAPD Academy
Infante, Anthony P. Jr.	Police Inspector, CO	JFK International Airport
Cirri, Robert D.	Lieutenant	Executive Officer
Kaulfers, Robert M.	Sergeant	PATH ESU
Amoroso, Christopher	Police Officer	Tactical Response Unit
Barry, Maurice V.	Police Officer	PATH ESU
Callahan, Liam	Police Officer	PATH ESU
Davis, Clinton	Police Officer	WTC Command
Foreman, Donald A.	Police Officer	Holland Tunnel Command
Froehner, Gregg J.	Police Officer	PATH ESU
Gorman, Thomas E.	Police Officer	PATH ESU
Houston, Uhuru Gonga	Police Officer	WTC Command
Howard, George G.	Police Officer	JFK ESU
Huczko, Stephen	Police Officer	Newark Int'l Airport Command
Jurgens, Paul W.	Police Officer	PAPD Academy
Laszezynski, Paul	Police Officer	PATH ESU
Lemagne, David P.	Police Officer	PATH Command
Lennon, John J.	Police Officer	PATH ESU
Levi, John D.	Police Officer	Port Authority Bus Terminal
Lynch, James F.	Police Officer	WTC Command
McIntyre, Donald J.	Police Officer	PATH Command
McNeil, Walter A.	Police Officer	Holland Tunnel Command
Navas, Joseph M.	Police Officer	PATH ESU
Nelson, James	Police Officer	PAPD Academy
Niedermeyer, Alphonese J.	Police Officer	Commercial Vehicle Inspection Unit
Parham, James W.	Police Officer	PAPD Academy
Pezzulo, Dominick A.	Police Officer	Port Authority Bus Terminal
Reynolds, Bruce A.	Police Officer	George Washington Bridge
Rodrigues, Antonio J.	Police Officer	Port Authority Bus Terminal
Rodriguez, Richard	Police Officer	PAPD Academy
Skala, John P.	Police Officer	Lincoln Tunnel Command
Stuart, Walwyn W.	Police Officer	PATH Command
Tietjen, Kenneth	Police Officer	PATH Command

Webb, Nathaniel	Police Officer	Holland Tunnel Command
Wholey, Michael T.	Police Officer	PATH Command
Sirius	Police K-9	Explosives Detection Team

Volunteer Responders

Bourdier, Francisco	Security at Deutche Bank Building
Costello, Charles G	Elevator Technician
Jurgens, Thomas E.	Volunteer Responder
Lovero, Joseph	Volunteer Responder
Thompson, Capt. Harry W.	Volunteer Responder
Wallace, Mitchel S.	Volunteer Responder

United States Government Personnel

Hatton, Leonard W.	Federal Bureau of Investigation
Miller, Craig James	U. S. Secret Service

Attachment 2
CHRONOLOGY OF EMERGENCY RESPONDER OPERATIONS, WORLD TRADE CENTER ATTACK, SEPTEMBER 11, 2001

Note: (E) indicates that time is an estimate from the original source or has been estimated by the authors based on the available data. All other times listed are based on time recordings or clock readings. These data are compiled from many different sources. The authors of this chronology have included the time based on the best possible data, and the detailed times showing hour, minute, and second are given to represent the exact sequence of events during a given minute or block of time from the same set of recorded data. Based on the variations of recorded and clock times or different time stamps on different sets of recorded data, it is estimated that the error in time for this chronology is on the order of ±2 minutes.

8:46 a.m. Aircraft strikes WTC 1 on north side causing serious building damage and starting fires on floors 94 through 98. (FEMA 403)
The aircraft impact is observed by FDNY personnel assigned to Engine 7 and Ladder 1 as they investigate a gas odor at street level at the intersection of Church Street and Lispenard Street. Ladder 8 is also located at this scene. (FDNY interviews; New York Times; CBS Television documentary)
Battalion 1 Chief (at the intersection of Church Street and Lispenard Street) calls in aircraft impact to the communications center. Personnel and apparatus at the gas odor immediately respond to WTC 1 about fourteen blocks away. The Chief is located at the intersection of Church Street and Lispenard Street.
2nd and 3rd alarms (Note: For FDNY a first alarm requires that the following apparatus be dispatched:

8:46 a.m. PAPD Police Desk radio report, Channel W – A unit reports by radio to the Police Desk at the World Trade Center that there has been an explosion at the World Trade Center. A PAPD unit reports that there are major injuries at the Plaza.

8:46 a.m. WTC Elevator operations radio report, PA Channel Z – (Note: Significant static on the following transmissions.) "…?… the building. Evacuate the building" "Evacuate the building." "…?… debris …?…" "…?… some kind of explosion."

8:46 a.m. WTC Security radio report, PA Channel X – There is an open microphone transmission with a lot of people yelling.

8:47 a.m. NYPD – Level 1 mobilization called; Level 3 mobilization called 8 seconds later (NYPD, McKinsey & Company, 2002)

8:47 a.m. Box 8087-2, location of alarm box - Fire Command Desk in WTC 2, location of alarm box in the lobby at Command Desk via Liberty Street Note: Each "Box" record represents the formal dispatch of a unit to the incident location of the "Box.". (FDNY Box Alarm data sheets)
Battalion 1 (WTC 1)
Battalion 2 (WTC 1 Command Post, fatalities)

Engine 4 (WTC 1, hydrant hookup, upper floors operations, fatalities)
Engine 6 (WTC 1, hydrant hookup, upper floors operations, fatalities)
Engine 7 (WTC 1, hydrant hookup, upper floors operations)
Engine 10 (1WTC, hydrant hookup, upper floors operations, fatality)
Engine 24 (WTC 1, upper floors operations)
Engine 263 (post collapse operations)
Ladder 1, (WTC 1, upper floors operations)
Ladder 8 (WTC 1, upper floors operations, evacuation of West St., fatality)
Ladder 10 (WTC 1, upper floors operations, fatalities)
Ladder 15 (WTC 2, search and evacuation, fatalities)
Rescue 1 (WTC 1, operation on upper floors, fatalities)
Marine 1 (evacuated injured to Jersey City, drafted water)
Marine 6 (operated fire boats Kane and Smoke, evacuated injured to Jersey City, drafted water)

8:47 a.m. WTC Security radio report, PA Channel X – "…?… There is a fire on 22."

8:47 a.m. WTC Elevator operations radio report, PA Channel Z – "A4 to …?… hook up" "Roger, evacuate the building, evacuate the building. Head out towards Building 5."

8:47 a.m. WTC Elevator operations radio report, PA Channel Z – "B6 …?… employees, avoid the Concourse, avoid the Concourse."

8:47 a.m. WTC Security radio report, PA Channel X – "…?… on the 22nd floor a lot of debris."

8:47 a.m. PAPD Police Desk radio report, PA Channel W – "The top ten floors of the Trade Center are on fire, possible aircraft.

8:48 a.m. EMS confirms incident (FDNY, McKinsey & company, 2002)

8:48 a.m. Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm data sheets)
SOC Battalion 1 (WTC 1, operations on upper floors, fatality)
Battalion 4 (WTC 1, fatality)
Battalion 6 (WTC 1, fatalities)
Battalion 7 (WTC 2, operation on upper floors, fatalities)
Engine 5 (WTC 1, hydrant hookup, upper floors operations, relayed water to E 247 & E 41, 5 WTC, fatality)
Engine 9 & Sat 1 (WTC 1, hydrant hookup, upper floors operations)
Engine 15 (WTC 1, upper floors operations)
Engine 28 (WTC 1, hydrant hookup, upper floors operations)
Engine 33 (WTC 1, hydrant hookup, upper floors operations, post collapse – relayed water from fire boat to manifold, fatalities)
Ladder 6 (WTC 1, upper floors operations, trapped in B stairway upon collapse)
Ladder 20, (WTC 1, upper floors operations, fatalities)

8:48 a.m. WTC Security radio report, PA Channel X – "…..Be advised I have two (ATM ?) workers down here on B2 between the red and the yellow lot. Be advised, I got two…workers hurt. I need a, ah, EMT down here ASAP." "Where do you need assistance for the (ATM?) workers?" "…?… between a the red lot and yellow lot where the walkway where the (ATM?) office is"

8:49 a.m. PAPD Police Desk radio report, PA Channel W – "……. (garbled)…..but start doing the evac, the upper levels. Have the units put on the Scot air-packs…apparatus."

8:49 a.m. WTC Security radio report, PA Channel X – "10-4, S4, I understand there may have been an explosion on Liberty Street."

8:49 a.m. WTC Security radio report, PA Channel X – "Stay off the air."

8:49 a.m. WTC Security radio report, PA Channel X – "…?… I need EMS by …?… I got a security guard that's hurt."

8:50 a.m. 5th alarm called for WTC 1 (FDNY, McKinsey & Company, 2002)
Command Post established at WTC 1 lobby by Battalion 1

8:50 a.m. Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm data sheets)
Engine 1 (WTC 1, fatality)
Engine 3 (WTC 2, WTC 7, WFC 3)
High Rise 1 (WTC 2, WTC 7, WFC 3)
Engine 16 (WTC 1, upper floors operations)
Engine 55 (WTC 1, Siamese connections, upper floors operations, fatalities)
Ladder 5 (WTC 1, upper floors operations, fatalities)
Rescue 2 (WTC 1, operations on upper floors, fatalities)
Rescue 4 (operations unknown, fatalities)
HAZMAT 1 (WTC 2, operations unknown, fatalities)

8:50:04 PAPD Police Desk radio, PA Channel W – FDNY Ladder 10 calls to identify which World Trade Center building was involved. "Ladder One Oh, WTC, Go ahead Ladder One Oh. …. Is it Two World Trade or One World Trade? (response PAPD) One World Trade, on the upper ten floors. (FDNY) Two or One? (response PAPD) Building One.

8:50:38 10-84, Engine 55, Note: This transmission was by error. FDNY, World Trade Center Incident Summary (WTC 1, Siamese connections, upper floors operations, fatalities. (FDNY CD12/CD15)

Note: Code 10-84 denotes that the unit has arrived at the scene.

8:50 – 8:59 Incident Command Post established in WTC 1 lobby (FDNY, McKinsey & Company, 2002)

14 units responding to WTC 1, all from lower Manhattan. Three of the 14 units reporting are dispatched from stations that have already sent other units to the WTC. (New York Times, website, timeline)

8:50:35 PAPD Police Desk radio report, PA Channel W – An Officer calls for chemical mobilization.

8:50:48 WTC Security radio report, PA Channel X – "…?… Be advised, I have two…. workers down here on B2 between the red and …Be advised I got two…workers I need an EMT down here ASAP." "Where do you need assistance for the ….workers?" "B2 between the red…walkway…"

8:51	EMS - 10-40 transmitted	Note: Code 10-40 denotes a gas or electrical condition.
8:51:12	PAPD Police Desk radio report, PA Channel W –"Four One to WTC" "Go ahead." "B1 Level ..(garbled).. We had a minor explosion or major explosion. Something happened down here." (Response) "There was an explosion on the upper floors."	
8:51:25	WTC Elevator operations radio report, PA Channel Z – "Everybody head over to the B Tower escalators. I'll set up over here."	
8:51:35	10-84, Ladder 1, (WTC 1, upper floors operations)	
8:51	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm data sheets) Squad 18 (WTC 1 operate on upper floors, fatalities)	
8:51:43	Box 9031, location of Alarm Box, West and Liberty Streets (FDNY Box Alarm data sheets) Battalion 31 (Command Post at WFC 3, Command Post at Marriott) Engine 205 (Command Post at West and Liberty Streets) Ladder 110 (WTC 1, up to 21st floor)	
8:52 (E)	10-60 alarm for WTC 1	Note: Code 10-60 denotes a Major Emergency (FDNY, McKinsey & Company, 2002)
8:52	NYPD – ESU responds to WTC, five ESU teams deployed into WTC buildings and plaza, one additional ESU team prepares for helicopter rescue that was canceled for safety reasons. (NYPD, McKinsey & Company, 2002) Aviation unit arrives at scene and examines possibility for roof rescue (NYPD, McKinsey & Company, 2002) Truck 1 establishes ESU Command Post at Church and Vesey Streets 30 extra staff members assigned to take 9-1-1 calls (NYPD, McKinsey & Company, 2002)	
8:52	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm data sheets) Engine 39 (WTC 1, upper floors operations, trapped in B stairway at collapse) High Rise 2 (WTC 1, upper floors operations) Rescue 3/RCO 1 (WTC 2, operations on upper floors, fatalities)	
8:52:01	10-84, Engine 18 (FDNY Box Alarm data sheets)	
8:52:09	PAPD Police Desk radio report, PA Channel W – "Eight One to TC" "CBD's aware; they're mobilizing at this time."	
8:52:17	WTC Elevator operations radio report, PA Channel Z – "Seven Two Six Mark." "Go John" "Elevator in A Tower is stuck right now…?…in the elevator." "Alright, John try to try to calm them down. There's nothing we can do right now. Stand by …?…" "OK"	
8:52:49	PAPD Police Desk radio report, PA Channel W – "People are jumping out the windows." (response) "What location?" "Tower 1."	

8:52:59 FDNY, Police Precinct 76. (FDNY Box Alarm Dispatch log)

8:53 EMS - 042 arrives and establishes EMS Command. (FDNY, McKinsey & Company, 2002)

8:53 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log)
Ladder 3 (WTC 1, upper floors operations, fatalities)

8:53:23 WTC Security radio report, PA Channel X – "…?… Please let me get through the PATH train. Something is going on at the PATH train. Can you ask somebody…?… make announcement 310B…people running out of the PATH train. Copy?"

8:54 Battalion 2 assigned as Comcord. (FDNY, McKinsey & Company, 2002)

8:54 NYPD – PAPD is notified to shut down all PATH tunnels and trains
All ESU teams advised to respond to Church and Vesey Streets. (NYPD, McKinsey & Company, 2002)

8:54 Almost 50 percent of special operations units deployed (FDNY Box Alarm Dispatch log)

8:54 EMS – Task forces are staging at Manhattan bridges. (FDNY, McKinsey & Company, 2002)

8:54 Box 1377, location of Alarm Box, Columbia and Woodhull Streets (FDNY Box Alarm Dispatch log)
Battalion 40 (Command Post at Marriott),
Battalion 48 (Operations unknown, fatalities),
Engine 202 (Command Post at WFC 3 on West Street)
Engine 204 (Command Post at WFC 3 on West Street)
Engine 210 (Command Post at West and Liberty Streets, hydrant hookup at West and Liberty, at WTC 1 Command Post when WTC 2 collapsed)
Engine 224 Command Post on West Street, relayed water to WTC 2, supplied hoselines for firefighting)
Engine 235 (WTC 2)
Engine 239 (Command Post at West and Vesey Streets, relayed water to E 24)
Ladder 101 (Command Post at West and Liberty Streets, operations in WTC 2, fatalities)
Ladder 105 (WTC 2, operations unknown, fatalities)
Ladder 131 (Command Post at West and Liberty Streets, while in Marriott WTC 2 collapsed, when exiting Marriott WTC 1 collapsed, all injured)
Ladder 132 (WTC 2, rescue work on upper floors, fatalities)

8:54:02 WTC Elevator operations radio report, PA Channel Z – "OS6, OS4 Bryan" "Go …?… we're on 33, C staircase. We're heading down." "All right hurry up Bryan. The lobby is a … mess Bryan. There's …?… on the way down. You come out of the building, there is … falling down from the side of the building, OK. Be very careful…?… a mess."

8:54:22 WTC Security radio report, PA Channel X – "… (?)… Do you know basically where the plane hit the building?" (Note: Two unreadable transmissions follow.) "…(?)… By the side right over the … (?)…" "Come back, I didn't read your transmission. It is on the

	side of Building Six Tower One." "…(?)… One hundred One floor you said?" " … (?)… I got too much… (?)… Here, if you can hear me … (?)… Can you hear me with so much commotion?" "What floor? …(?)… Building Seven. …(?)… Hit Building Seven." "No it hit World Trade Center One but … (?)… Building Seven. Copy?" "What floor did it hit?" "….(?)… All the way at the top … (?) … and above." (FDNY Box Alarm Dispatch log)
8:54:31	10-84, Ladder 20, (WTC 1, upper floors operations, fatalities)
8:54:39	10-84, Battalion Chief 2, (WTC 1 Command Post, fatalities)
8:54:41	WTC Security radio report, PA Channel X – "…?… by the side right over the …?…" "Come back, I didn't read your transmission." "It is on the side of Building 6, Tower 1, …." "101st floor you said?" "I got too much ….hear if you can hear me…" "Can you hear me with so much commotion?" "What floor?"
8:54:42	10-84, Ladder 6, (WTC 1, upper floors operations, trapped in B stairway upon collapse) (FDNY Box Alarm Dispatch log)
8:54:49	WTC Elevator operations radio report, PA Channel Z – "…?…B to all ACE employees report down to 310B lobby."
8:54:57	FDNY report of people trapped on 106th floor of World Trade Center 1. (FDNY, World Trade Center Incident Summery, 2001)
8:55	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log) Squad 1 (operations unknown, fatalities)
8:55 a.m.	The first fire companies arrive at WTC 1. Some firefighters start up stairs. (New York Times, website, timeline)
	Chiefs set up command post in lobby of WTC 1.
8:55	EMS – Initial staging area established on West Street across from WTC 1. (FDNY, McKinsey & Company, 2002)
8:55:02	FDNY report of people trapped on 87th floor of World Trade Center 1. (FDNY, World Trade Center Incident Summery, 2001) (FDNY Box Alarm Dispatch log and CD12/CD15)
8:55:12	10-84, Engine 15 (WTC 1, upper floors operations)
8:55:18	10-60, Called by Division Chief 1
8:55:21	10-84, Rescue Squad 1 (operations on upper floors, fatalities)
8:55: 37	10-84, Engine 24 (WTC 1, upper floors operations)
8:55:48	FDNY radio dispatcher relays that people are trapped on the 106th floor and Division Chief 1 (DC01) states he has units on the way up. He has unconfirmed reports of fire on

the 78th floor. He also requests Police Department for security. (FDNY World Trade Center Incident Summary notes, 2001)

8:55:49 10-84, Engine 4 (WTC 1, hydrant hookup, upper floors operations fatalities) (FDNY Box Alarm Dispatch log)

8:56 NYPD – ESU sends team to meet helicopters for possible roof rescue. (NYPD, McKinsey & Company, 2002)
(FDNY Box Alarm Dispatch log and CD12/CD15)

8:56:11 10-84, Ladder 5 (WTC 1, upper floors operations, fatalities)

8:56:22 10-47, from FDNY Note: Code 10-47 denotes request for police response.

8:56:24 PAPD Police Desk radio report, PA Channel W – "Plaza, be advised through our contact ….?.... We still have trains coming into the Trade Center."

8:56:30 10-84, Battalion Chief 7 (WTC 2, operation on upper floors, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

8:56:30 WTC Security radio report, PA Channel X - …(?)… Go. Need an ambulance immediately at Building Four. Have a person injured here. Building Four. That's a copy.

8:56:32 WTC Security radio report, PA Channel X – "Need and ambulance immediately at Building 4. Have a person injured here." "Building 4, that's a copy."

8:56:44 WTC Security radio report, PA Channel X – "…?… security dispatch on the side of Building 4 and 2. We have people trying to exit out of the building. Need some assistance…on keeping the people inside." "That's a copy."

8:56:51 WTC Security radio report, PA Channel X - … (?)… security officer dispatch on the side of Building Four and Two. We have people trying to exit out of the building. Need some assistance… (?)… on keeping the people inside. That's a copy

8:57 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Squad 288 (operations unknown, fatalities)

8:57:20 10-84, Engine 5, (WTC 1, hydrant hookup, upper floors operations, relayed water to E 247 & E 41, 5 WTC, fatality) (FDNY Box Alarm Dispatch log and CD12/CD15)

8:57:27 PAPD Police Desk radio reports, PA Channel W – Unit reports broken water pipes at the P4 Level.

8:57:30 WTC Security radio report, PA Channel X – "Don't let anyone in the building." "Evacuate the Plaza at this time."

8:57:33 WTC Security radio report, PA Channel X – Evacuate the Plaza at this time.

8:57:49 WTC Elevator operations radio report, PA Channel Z – "Seven, Seven, all ACE mechanics respond down to 310 fire command. Seven, seven, all ACE mechanics respond down to 310 fire command."

8:57:52 FDNY Battalion Chief 2 (BC02) advises there are jumpers and confirms for Division Chief 1 (DC01) that the jumpers have already jumped. (FDNY World Trade Center Incident Summary notes, 2001)

8:58 NYPD – Chief of Department calls Level 4 mobilization. (NYPD, McKinsey & Company, 2002)

8:58 EMS – Staging established at Church and Fulton Streets. (FDNY, McKinsey & Company, 2002)

8:58:04 WTC Security radio report, PA Channel X – "What elevators are running in Building number One?" …(?)… OCC… (?)… "S2 to all security guards, hold your posts. Don't allow people in … (?)… Do not allow anyone into the courtyard or any … (?)… leading into the …(?)… copy?"

8:58:09 10-84, Battalion Chief 6, (WTC 1, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

8:58:26 WTC Security radio report, PA Channel X – "S2 to all security guards, hold your posts. Don't allow people in the Plaza…Do not allow anyone onto the Courtyard or any … leading into the …" "Copy?"

8:58:29 10-84, Engine 3, (WTC 2, WTC 7, WFC 3) (FDNY Box Alarm Dispatch log and CD12/CD15)

8:58:48 PAPD Police Desk radio report, PA Channel W – "Seventy Ninth floor. We have various people trapped at that location."

8:59 NYPD – First ESU team enters WTC 1. (NYPD, McKinsey & Company, 2002)

8:59 Eighteen fire apparatus are parked outside of WTC 1. (New York Times website)

8:59:08 Dispatch 5th alarm (FDNY Box Alarm Dispatch log)

8:59:12 WTC Security radio report, PA Channel X – "…?… the Plaza. Evacuate the people." (FDNY Box Alarm Dispatch log and CD12/CD15)

8:59:26 10-84, Engine 28, (WTC 1, hydrant hookup, upper floors operations)

8:59:32 10-84, Engine 202, (Command Post at WFC 3 on West Street)

8:59:32 PAPD Police Desk radio report, PA Channel W –"Eight One, TC" "Go One." "As soon as we're able, I want to start a building evacuation, building one and building two, till we find out what caused this."

8:59:41 10-84, Ladder 101, (Command Post at West and Liberty Streets, operations in WTC 2, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

8:59:47 WTC Security radio report, PA Channel X – "Sir, be advised on forty-four, Building One, I have people upstairs… (?)… Copy?" "We are aware … (?)…EMS… (?)… emergency people in route. …(?)…up there. You all right?"

8:59:54 PAPD Police Desk radio report, PA Channel W – "Let's begin an evacuation of the entire complex." "All buildings, copy?" "Roger 8."

9:00 second 5th alarm for WTC 1

9:00 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 21 (WTC 1, hydrant hookup, upper floors operations, fatality)
Engine 34 (WTC 1, operated at Command Post and Field Comm Unit)
Engine 54 (WTC 1, operations unknown, fatalities)
Engine 65 (WTC 1, upper floors operations)
Engine 207/Sat. 6 (WTC 1, hydrant hookup, Siamese to 90 West Street, upper floors operations WTC 1, fatalities)
Engine 226 (Command Post on West Street, provided water from hydrant, operations unknown, fatalities)
Ladder 9 (WTC 1, upper floors operations, fatalities)
Ladder 18 (WTC 1, lower floors operations)
Rescue 5 (operations unknown, fatalities)

9:00:07 WTC Security radio report, PA Channel X – "…to S4" "Be advised suite 4711 Building 1, there is a report of glass…" "…couldn't get outside the room. There're stuck inside

9:00:26 FDNY radio dispatcher advises smoke is on 83rd, 103rd, and 104th floors, reiterates about the people trapped on the 106th floor. (FDNY World Trade Center Incident Summary notes, 2001)

9:00:33 WTC Security radio report, PA Channel X - "S4 to 77, K" "Be advised, you have a report of an injured person two World Trade between the 14th and 15th floor. OK"

9:00:51 WTC Elevator operations radio report, Channel Z – "…?…" "Go" "Yea Pete, I'm stuck in the stairway."

9:00:54 PAPD Police Desk radio report, PA Channel W – "Building five, start to evacuate building five?" "Stand by on building five." "Roger." (Skip portion of transmission) "Go down to the B4 level …." "Roger" "…Start at the B4 level for evacuation." "Affirmative."

9:00 – 9:09 Most companies arriving during this period go the WTC 1. (New York Times, website, timeline)

9:01 – 9:03 (E) FDNY Incident Command Post is established on West Street opposite WTC 1 (FDNY, McKinsey & Company, 2002)

9:01 NYPD – 1st and 5th precinct Executive Officers advise new mobilization point at Vesey and West Streets (NYPD, McKinsey & Company, 2002)

9:01 EMS - Assistant Chief of EMS arrives (FDNY, McKinsey & Company, 2002)

9:01:09 FDNY radio dispatcher advises Car 4D that there are 25 to 30 people trapped on the 104th floor back room, and 103rd floor north room. Also reports people trapped on 83rd floor. FDNY World Trade Center Incident Summary notes, 2001)

9:01:58 PAPD Police Desk radio report, PA Channel W – "Evacuate all buildings in the complex. You copy? All buildings in the complex." "Roger. Units evacuate all units, all tenants in the buildings, at the Trade, at the Trade Center."

9:01:59 10-84, Safety Battalion 1 (FDNY Box Alarm Dispatch log)

9:02:43 FDNY reports people trapped on 105th floor of World Trade Center 1. (FDNY, World Trade Center Incident Summery. 2001)

9:03 a.m. Aircraft strikes WTC 2 on the south side causing serious building damage and starting fires on floors 78 through 84. (FEMA 403)

A command post is set up in WTC 2 on the West Street side. A second fifth alarm is established to support operations in WTC 2. Sixteen firehouses from lower Manhattan have units responding to the WTC. Five of the sixteen firehouses have multiple units responding to the WTC. (New York Times, website, timeline)

9:03 Incident Command Post established on West Street across from 6 WTC (FDNY, McKinsey & Company, 2002)

9:03 NYPD – Level 4 mobilization transmitted on Citywide 1 (NYPD, McKinsey & Company, 2002)

9:03:00 10-84, Ladder 110, (WTC 1, search and evacuation up to 21st floor) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:03:08 FDNY report of person trapped on 68th floor of World Trade Center, building not identified. (FDNY World Trade Center Incident Summary, 2001)

9:03:22 WTC Security radio report, PA Channel X – "S4…?… The A stair case is clear, copy, from 77 to …?…"

9:03:33 PAPD Police Desk radio report, Channel W – "Some kind of explosion in building 2." "Roger."

9:03:37 WTC Security radio report, PA Channel X – "…?… Hit the building. Another plane …?… Another plane just hit the building… (?)… Liberty Street

9:03:50 10-84, Engine 205, (Command Post at West and Liberty Streets) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:03:51 FDNY radio dispatcher advises Car 4D (Car 4D is the Incident Command's Vehicle) about the second plane hitting World Trade Center 2 and advises about people trapped on the 83rd floor in room 8311. (FDNY World Trade Center Incident Summary notes, 2001)

9:03:52 WTC Security radio report, PA Channel X – "S4 to FCC" Run those smoke units. They'll clear the air up there."

9:04:09 10-84, Battalion Chief 31, (Command Post at WFC 3, Command Post at Marriott) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:04:30 PAPD Police Desk radio report, PA Channel W – "Be advised that a second plane has struck the building." (Response) "Be advised, the building has already been shut down." (Response) Be advised, another aircraft has struck the building."

9:04:50 PAPD Police Desk radio report, PA Channel W – "We have visual on that. Not known if it was a second plane, possibly a missile."

9:05 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion 8 (Command Post, operations unknown, fatality),
Battalion 9 (Command Post, operations unknown, fatalities)

9:05:21 FDNY radio dispatcher attempts to reach Car 4D which he is unable to contact. The dispatcher relays the information to Division Chief (DC 01). (FDNY World Trade Center Incident Summary notes, 2001)

9:05:51 PAPD Police Desk radio report, PA Channel W – "Eight One, TC" "Go ahead Eight One." "The city is aware, right, that we need every ambulance that we, ah, that they can spare? Correct?" (response) I've notified them again, about five minutes that we have to mobilize everybody. Be advised. We still have people trapped on the upper floors. Fire crews have some units up there to evacuate.

9:05:51 FDNY report of a few hundred people trapped on 104th floor of the World Trade Center, building not identified. (FDNY World Trade Center Incident Summary, 2001)

9:05:48 FDNY radio communications, PA, WTC Channel 30 repeater – (Note: This series of communications started at 9:05:48 and ended at approximately 9:07:37.) "Battalion 1 to Battalion 7" "Battalion 1 to Battalion 7" "Battalion 7 to Battalion 1, How do you read me?" "Battalion 1 to Battalion 7" "Battalion 7 to Battalion 1, How do you read me?" "Battalion 1 to Battalion 7" "Battalion 7 to Battalion 1, How do you read me?" "Four Bravo to One" (Note: Period of mixed transmission and walkover followed by a possible female voice "20") "Battalion 1 to Battalion 7" "Bravo to 7" "Go ahead Bravo from Battalion 7" (Note: possible female voice "…?…closed to 10 o'clock") "I'm down in the lobby and I can read ya." "Battalion 1 wanted a radio check." (Note: possible female voice "…?… doing some work;") "Battalion 1 to Battalion 7, I don't think we have the report. I picked you up on my radio but not the hard wire." "Alright, would you want me to remain on channel 7 or go the channel 1?" "…?… Bravo to Field Com" "…?… We're going to have to use the car repeater. You said you have the repeater on." "I'm going to give it to Chief Burns in the lobby of Tower 2." "OK, we're going to need something in this Tower 1 here." "Alright, I've got the repeater on … (walkover)… radio OK." "Battalion 7 to Battalion 1" "Battalion 1, we ah, we'll use this channel 2 in, ah, this building as a command channel for the Chiefs." "Alright, you're going to stay on channel 1 for the tactical." "Stay on tactical, um …?…, on the command channel 2." "10-4"

9:05:53 WTC Security radio report, PA Channel X – "SS6 to anybody." "Go" "We have a fire here and the smoke is developing and we can't even breathe. We have eyes burning here." "That's a copy, sir."

9:06 NYPD – (Chief of Department) orders that no aerial rescue is to be attempted. (NYPD, McKinsey & Company, 2002)

9:06:31 PAPD Police Desk radio report, PA Channel W – "Units on channel W, this is 8581 Sierra. There's been a reported missile launching from the Woolworth Building. CPD, if you are monitoring, get in touch with New York City. Have them check the Woolworth Building roof top.

9:07 EMS – Assistant Chief of EMS Ops assumes command. EMS Ops moves into lobby and coordinates with Fire Department. (FDNY, McKinsey & Company, 2002)

9:07 (E) FDNY Chief and NYPD Chief receive briefing from FBI officer at Church and Vesey Streets. (NYPD, McKinsey & Company, 2002)

9:07 NYPD – Police Chief (PC) orders Command Post to be set up at Barclay Street. (NYPD, McKinsey & Company, 2002)

9:07:20 WTC Security radio report, PA Channel X – "…?… Ok, I'm still evacuating 4 World Trade, 4 World Trace Center, going to Building 5. I have people going crazy." "Let them go out Building 4. Let them go out Building 4 to the side." "That's a 10-4. I'll let them go 4 World Trade Center."

9:08 Box 9998, location of Alarm Box, WTC special box assignment for the attack (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 22 (WTC 1, upper floors operations, fatalities),
Engine 40 (Reported to Command Post WTC 2, operations unknown, fatalities),
Engine 44 (West and Vesey Streets, ordered to maintain street control, assisted Marine 1 with water supply),
Engine 53 (2 WFC, street control, water supply and hose lines),
Engine 211 (hydrant hookup at Barclay and Church Streets, at Command Post at West and Vesey Streets when WTC 2 collapsed),
Ladder 11 (WTC 2, upper floors operations, fatalities),

9:08 – 9:13 (E) FDNY establishes a Lobby Command Post inside WTC 2 at the Fire Command Desk. (FDNY, McKinsey & Company, 2002)

9:08:27 WTC Security radio report, PA Channel X – "…?… Martinez to the units that are listening. Bring …Liberty Street…5 World Trade Center." "Debris coming down. Let em out, let em out, let em out, little by little, let em out." "I got debris falling from 2 World Trade Center by 4 World Trade Center, Liberty." "By Liberty, let em out. I can see, not that much debris." "Alright 10-4."

9:09 Box 9998, location of Alarm Box, WTC special box assignment for the attack (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion 10 (Command Post, West and Vesey Streets),
Battalion 12 (Marriott, supervised operations at Command Post, fatalities),
Ladder 2 (WTC 2, operations unknown, fatalities),
Ladder 13 (WTC 1, upper floors operations, fatalities)

Ladder 16 (Command Post at 2 WFC, fatalities)

9:09 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion Chief 11 (WTC 1, operated with Ladder 110, used elevator to travel up to the 16th floor, operations up to the 35th floor, trapped in B stairway with Ladder 6, Engine 16, Engine 39, Battalion Chief 2, and one civilian at collapse) CD12/CD15 and "Last Man Down"
Ladder 22 (Marriott)

9:09:26 PAPD Police Desk radio report, PA Channel W – "Eight One, WTC, Eight One. Be advised, we have 105 people, 75 to 100 people trapped up on the Windows of the World, up on the 106th floor….garbled… starting to panic. Roger, we copy."

9:09:05 10-84, Battalion Chief 4, (WTC 1 fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:09:42 WTC Security radio report, PA Channel X – "…?… OK? They are aware you can't open that door. They'll be up there to get the debris out of the way.

9:09:51 WTC Security radio report, PA Channel X – "Quartermaster WTC, Be advised the fire department is now … going into the elevator bank L1L2. Copy?"

9:10 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY, Box Alarm Dispatch log and CD12/CD15)
Engine 201 (WTC 2, operations unknown, WTC 2 post collapse, fatalities),
Engine 240 (At staging area West and Albany Streets when WTC 2 collapsed, stretch hoselines, relayed water from Marine 1, extinguished fire at 90 West street.)
Engine 249 (post collapse operations, victim rescue and fires extinguished using hand extinguishers)
Engine 278 (post collapse operations)
Ladder 102 (post collapse operations, evacuated Brooklyn Battery Tunnel)
Ladder 113 (Command Post at West and Liberty Streets, on way to WTC 2 when it collapsed, then to 3 WTC)
Ladder 114 (Reported to Albany and West Streets, arrived just post collapse of WTC 2)
Ladder 119 (post collapse operations, operated Tower on 5 WTC)
Ladder 122 (Reported to Command Post on West street, in Marriott lobby when WTC 2 collapsed)

9:10 Box 9998, location of Alarm Box, WTC special box assignment for the attack (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 23 (Marriott, operations unknown, fatalities)
Engine 209 (Command Post at West and Vesey Streets)
Engine 212 (approaching WTC 2 from CP at collapse.)
Engine 214 (Command Post at WTC 2, operations unknown, fatalities)
Engine 216 (WTC 2 firefighter killed by human falling from Tower, fatality)
Engine 217 (WTC 2 assisted E 216 with injured firefighter, fatalities)
Engine 220 (Command Post West and Liberty Streets, approaching WTC 2 at collapse, extinguish fire on 9th floor of Gateway Plaza, assisted with water relay from Marine 1 to Vesey and West streets)

Engine 221 (Command Post at WFC 3 West Street, approaching WTC 2 at collapse, set up water relay and hand lines)
Engine 229 (at Command Post 1 WFC on West Street when WTC 2 collapsed, supplied Tower Ladder 146 and 58)
Engine 230 (Command Post at West and Liberty Streets, operations unknown, fatalities)
Engine 235 (WTC 2, operations unknown, fatalities)
Engine 238 (WTC 2, ordered to search upper floors, building collapsed while unit was in stairway, fatality)
Engine 279 (WTC 2 operations, hydrant hookup West and Liberty, fatalities)
Ladder 7 (WTC 2, operations unknown, fatalities)
Ladder 12 (Marriott, upper floors, fatalities)
Ladder 24 (Marriott, search and evacuation)
Ladder 118 (WTC 2, operations unknown, fatalities)

9:10 (E) Chief of EMS Ops arrives at WTC

9:10 100 percent of rescue and high rise units are deployed (FDNY Box Alarm Dispatch log)

9:10:01 FDNY report of people trapped in 86th floor suite 8617, World Trade Center 2. (FDNY World Trade Center Incident Summary, 2001)

9:10:06 WTC Security radio report, PA Channel X – "(Section Manager?) The express elevators could be in jeopardy of falling. Be prepared for that. Do you copy?" (Note: No recorded response to this transmission.)

9:10:19 PAPD Police Desk radio report, PA Channel W – "TC …garbled…, Report of burning jet fuel up on five one, jet fuel on five one, eight, eight. (Response) That was 51st floor, smell of jet fuel? Negative, burning jet fuel, burning jet fuel, Roger. (Response) Ladder ten you copy that? FDNY, on the 51st floor, burning jet fuel.

9:10:40 10-84, Engine 34, (WTC 1, operated at Command Post and Field Comm Unit) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:10 – 9:19 Companies arriving now are mostly sent to WTC 2. A third command post is established at the Marriott Hotel, 3 WTC. 50 companies have arrived on the scene. 23 units from Manhattan (8 of 23 units represent multiple units from the same firehouse) units are from lower and central Manhattan, 4 units arrive from Brooklyn, 2 units arrive from Queens, and 1 unit arrives from The Bronx. (New York Times website, timeline)

9:11 FDNY - Field Com begins to maintain status (FDNY, McKinsey & Company, 2002)

9:11 NYPD – Back-up transmitter for Citywide channel put in service in anticipation of potential problem with primary transmitter on WTC 1 (NYPD, McKinsey & Company, 2002)

9:11 EMS – Staging area designated at West and Vesey Streets (FDNY, McKinsey & Company, 2002)

9:11 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)

Squad 252 (Command Post WTC 1, operated on upper floors, on 20th floor worked to remove occupants from elevator, fatalities)

9:11:02 EMS, Trauma, need numerous EMS units (FDNY, McKinsey & Company, 2002)

9:11:37 FDNY reports that Engine 10 requests that all responding units stop short of the World Trade Center buildings, either North or South of Liberty and West streets due to large amount of ambulances on the scene and debris falling from the buildings. (FDNY World Trade Center Incident Summary notes, 2001)

9:12:21 FDNY reports people trapped on 83rd floor of World Trade Center 2. (FDNY World Trade Center Incident Summary, 2001)

9:12:22 WTC Security radio report, PA Channel X – "310B to any unit. Be advised that Building 2 …Warden Phones. We can't pick up Warden Phones. We're just making straight announcements, telling the people not to stay at the Warden phones. We can't pick them up." "That's affirm."

9:13 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion 41 (Staging area at Brooklyn Battery Tunnel, responded to Vesey Street Command Post)
Battalion 42/32 (Staging area at Brooklyn Battery Tunnel, responded to Command Post at Broadway and Vesey Streets, 5 WTC)

9:13:02 FDNY reports a second time a person trapped on the 68th floor of World Trade Center, building not identified. (FDNY World Trade Center Incident Summary, 2001)

9:13:11 PAPD Police Desk radio report, PA Channel W – "A1, WTC, … A1. They want a Port Authority representative at the Fire Command A-SAP."

9:13:12 WTC Security radio report, PA Channel X – "I'm locked out of 4 World Trade Center. Where do you want me to go?"

9:13:18 10-84, Battalion Chief 9, (Command Post, operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:13:23 WTC Security radio report, PA Channel X – "Let them out by Building 4." "….?…" Let em out by Church Street, by Church Street. Let the people out to Church Street."

9:13:28 10-84, Engine 65, (WTC 1, upper floors operations) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:13:39 10-84, Engine 226, (Command Post on West Street, provided water from hydrant, operations) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:13:39 PAPD Police Desk radio report, PA Channel W – "Eight to TC. Be advise I'm responding to Fire Command. Copy?"

9:13:39 WTC Security radio report, PA Channel X - : Building 1 is flooding. Building 1 is flooding.

9:13:49	WTC Security radio report, PA Channel X – "There's a lot of water in Building 1. It's flooding."
9:14	Box 9998, location of Alarm Box, WTC special box assignment for the attack (FDNY Box Alarm Dispatch log and CD12/CD15) Engine 47 (WTC 1, upper floors operations), Engine 58 (Lobby of Marriott, fatality), Engine 74 (Marriott, upper floors operations, fatality), Engine 76 (2 WFC, hydrant hookup, Siamese connections on Vesey Street), Engine 91 (Command Post/West Street) Ladder 4 (operations unknown, fatalities) Ladder 21 (operations unknown, fatalities) Ladder 22 (Marriott, upper floors operations, in route to WTC 2 at collapse) Ladder 25 (WTC 2, operations unknown, fatalities), Ladder 35 (WTC 2, operations unknown, fatalities)
9:14:02	PAPD Police Desk radio report, PA Channel W – "Eight One, WTC." "Eight One." "Can we get someone up to the 105th floor, Windows of the World, 75 to 100 people. They need …garbled… They're loosing …garbled… options at the location."
9:14:20	WTC Security radio report, PA Channel X – "Evacuate, evacuate …?…"
9:14:21	PAPD Police Desk radio report, PA Channel W – "TC1," "Head" "Alright, fourteen oh, confirmation at this time, we have no elevators working." (response) No elevators above?" "That's affirmative."
9:15	5th alarm for WTC 2, a radio communication from the PA, WTC Channel 30 repeater recording NYPD calls for the evacuation of the United Nations building. (NYPD, McKinsey & Company, 2002)
9:15	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15) Engine 26 (operations unknown, fatalities), Engine 289 (ordered to pickup air cylinders at Mask Service Unit, arrived at WTC 1 during collapse)
9:15:00	PAPD Police Desk radio, PA Channel W – (Note: Radio communications on channel W is very poor at this time. Static and multiple signals mixing with garbled communications)
9:15:28	PAPD Police Desk radio, PA Channel W – (Note: A radio mike is stuck open. There is a repeated whaling sound from a building alarm system. The mike is keyed again at, and the transmission stops.)
9:15:34	10-84, Special Operations Command 1, (WTC 1, operations on upper floors, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:16 (E) FDNY Command Post and Staging area designated for WTC 2 at West and Albany Streets. (FDNY, McKinsey & Company, 2002)

9:16 (E) NYPD – Manhattan South begins to establish perimeter 2 blocks around WTC (NYPD, McKinsey & Company, 2002)

9:16:27 10-84, Engine 207/Sat. 6 (WTC 1, hydrant hookup, Siamese to 90 West Street, upper floors operations WTC 1, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:16:30 FDNY radio dispatchers advise Car 3 that there are people trapped in World Trade Center Building 1 at the following locations: 82nd floor east side, 83rd floor room 8311, 103rd floor room 103 near corner, 104th floor, and 106th floor. World Trade Center Building 2 at the following locations: 82nd floor west side, 88th floor, 89 floor. (FDNY World Trade Center Incident Summary notes, 2001)

9:16:53 10-84, Rescue Squad 3, (WTC 2, operations on upper floors, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:17 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 286/10 (initially out of service, back in service at 0917, relocated to E-10, arrived at WTC 1 when it collapsed, relayed water from Marine 1, fought fires from upper floors of 85 West street to 90 West street)

9:17:03 10-84, Rescue Squad 4, (operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:17:20 FDNY radio communications, PA, WTC Channel 30 repeater – "Battalion 7, Battalion 7 Alpha" "Alpha" "Alright, we're sending the elevator down to ya." "10-4"

9:17:50 PAPD Police Desk radio report, PA Channel W – "Eight One from WTC." "Eight One." "Roger, if possible can you go with the status of the evac? I've got four callers loosing oxygen on the 106th floor, One World Trade." Roger, we've got people going up there now. "Roger, Eight One."

9:17:58 10-84, Engine 21, (WTC 1, hydrant hookup, upper floors operations, fatality) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:18:01 FDNY radio communications, PA, WTC Channel 30 repeater – "This is …?… Battalion 7 in the South Tower to lobby command post, Tower 2." "…?… not …?… reading you. Not picking you up."

9:18:14 FDNY radio communications, Channel 30 repeater – (Note: Battalion 7 is on floor 40 in WTC 2. There is one elevator working to the 40th floor.) "This is Battalion 7 on floor 40 in Tower 2. We've got one elevator working up to the 40th floor staffed by a member of Latter One Five, K."

NYPD calls for the evacuation of the Empire State Building. (NYPD, McKinsey & Company, 2002)

9:18:29 10-84, Ladder 21, (operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:18:43	WTC Security radio report, PA Channel X – Nancy, its Salinger. The fire department tells me they're abandoning …?… and go across the street, copy, because there is too much stuff falling." "Salinger abandon…." "The door is completely closed." "That's a copy, door is completely closed."
9:18:55	10-84, Hazmat 1, (WTC 2, operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:19	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15) Ladder 149 (Staging area West and Chambers Street, post collapse operations)
9:19:45	10-84, Ladder 12, (Marriott, upper floors, fatalities)
9:19:53	l0-84, Ladder 24, (Marriott, search and evacuation)
9:20 – 9:29	WTC 2, three fire companies travel to 40th floor by work elevator and check offices to be sure civilians have evacuated. (New York Times, website, timeline)
	30 Manhattan firehouses report companies dispatched. 10 of the 30 firehouses have multiple units responding. Manhattan firehouses are from lower, central, and northern parts of the borough. Brooklyn has 7 firehouses with units dispatched, 1 of the 7 houses has multiple units responding. Units from Brooklyn use the tunnel and bridges to enter Manhattan. (New York Times, website, timeline)
9:20 (E)	EMS – Division 3 Chief in WTC 1 lobby assigned as operations chief and reports to Incident Command Post (FDNY, McKinsey & Company, 2002)
9:20:04	PAPD Police Desk radio report, PA Channel W – "A2Jouilie and A2, ah David ..?.. . Be advised that the, ah, B4 Levels a negative condition down there. No one's down there. Also, be advised there are four additional Path Officers down stairs. Copy?" "Roger"
9:20:55	PAPD Police Desk radio, PA Channel W – PAPD begins a roll call for personnel accountability check.
9:21:48	10-84, Ladder 35, (WTC 2, operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:22	FDNY radio communications, PA, WTC Channel 30 repeater: Battalion 7 is on 43rd floor of WTC in B stairway.
9:22	NYPD – ESU requests mobilization of off-duty personnel (NYPD, McKinsey & Company, 2002)
9:22:07	10-84, Engine 76, (2 WFC, hydrant hookup, Siamese connections on Vesey Street) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:22:15	FDNY radio communication, PA, WTC Channel 30 repeater – "Battalion 7 Chief" "Battalion 7, Go" "The emergency service cops want to back you up. Can you tell them

where you are?" "They got a …?… with them?" "We're on the 43rd floor. We're in stairway B."

9:23 EMS – Tour 1 Chief arrives and establishes EMS liaison at Incident Command Post on West Street. Division 3 Chief arrives at West Street Incident Command Post. Tour 1 Chief transfers responsibility to Division 3 Chief. Assistant Chief of EMS Ops moves to Incident Command Post at West Street (FDNY, McKinsey & Company, 2002)

9:23 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 233 (post collapse operations)
Ladder 104 (post collapse operations, collected BF-4 riding lists from abandoned apparatus)
Ladder 161 (post collapse operations, Staging area West and Chambers Street)

9:23 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 274 (ordered to pick up air cylinders from Mask Service Unit, arrived at WTC 1 at time of collapse)

9:23:08 FDNY radio dispatcher advises Field Comm that 100 people are overcome in Building #1 on the Northwest and Southwest corners of the 103rd floor. Also the dispatcher reports that Ladder 3 reports numerous injuries in the stairwell from the 35th floor on up. (FDNY World Trade Center Incident Summary notes, 2001)
(FDNY Box Alarm Dispatch log and CD12/CD15)

9:23:27 10-84, Ladder 11, (WTC 2, upper floors operations, fatalities)

9:23:33 10-84, Ladder 2, (WTC 2, operations unknown, fatalities)

9:23:51 10-84, Engine 40, (Reported to Command Post WTC 2, operations unknown, fatalities)

9:24 FDNY radio communication, PA, WTC Channel 30 repeater - Battalion 7 is on the 48th floor of WTC 2.

9:24 EMS – Second staging area is established at West and Chambers Streets
Vesey Division established at West and Vesey Streets (FDNY, McKinsey & Company, 2002)

9:24:17 FDNY radio communication, PA, WTC Channel 30 repeater – "59, 15" "Go ahead …9" "Just got a report from the, ah, director of Morgan Stanley. …?…they've taken the brunt of the stuff. There are a lot of bodies, said that the stairway is clear all the way up though." "Alright 10-4 Scott. What floor are you on?" "48, right now." "Ah, 10-4, we're coming up behind ya."
(FDNY Box Alarm Dispatch log and CD12/CD15)

9:24:20 10-84, Ladder 114, (Reported to Albany and West Streets, arrived just post collapse of WTC 2)

9:24:22 10-84, Engine 278, (post collapse operations)

9:24:45 PAPD Police Desk radio report, PA Channel W – "Advise that other bodies are coming down and that people are on the street. There's a lot of debris. If there's a way to get the people off the street and out of the courtyard." "Roger. What's that location …?" "The middle courtyard between five and one, that I came across first, and I believe it's on, on the side of One to my left. I'm still in the building; people are coming down from 64." (FDNY Box Alarm Dispatch log and CD12/CD15)

9:25:02 10-84, Ladder 131, (Command Post at West and Liberty Streets, while in Marriott WTC 2 collapsed, when exiting Marriott WTC 1 collapsed, all injured

9:25:03 10-84, Engine 279, (WTC 2 operations, hydrant hookup West and Liberty, fatalities)

9:25:10 FDNY Brooklyn dispatcher advises Manhattan dispatcher that people are trapped in World Trade Center Building #5 on the 80th floor. Manhattan is unable to raise Field Comm but is able to relay message to Division Chief 11 (DC 11). FDNY World Trade Center Incident Summary notes, 2001)

9:25:38 FDNY radio communication, PA, WTC Channel 30 repeater – "7 Alpha to 7" "Go ahead Steve" "Yea Chief, I'm gonna stop on 44 K?" "Take your time." "10-4"

9:26 NYPD – ESU units set up at Vesey and West Streets and prepare to enter towers.

9:26:27 PAPD Police Desk radio report, PA Channel W – "TC, A One" "Go ahead A One" "Have the units respond to the fire command desk immediately." "Roger" "All units respond to the Fire Command Desk and meet up with A One, (Devona?)"

9:27 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 264 (Staging area at Brooklyn Battery Tunnel, post collapse operations)
Engine 311 (stretched lines from Marine 1 to 85 West Street, from up inside of 85 West Street extinguished fires on roof of 90 West Street)
Ladder 133 (Command Post at West and Chambers Streets, to Command Post at Broadway and Vesey Street, 3 WTC)

9:27:35 10-84, Division Chief 11 (FDNY Box Alarm Dispatch log)
(FDNY Box Alarm Dispatch log and CD12/CD15)

9:28:11 10-84, Battalion Chief 10, (Command Post, West and Vesey Streets)

9:28:12 10-84, Ladder 16, (Command Post at 2 WFC, fatalities)

9:28:16 PAPD Police Desk radio report, PA Channel W – "TC Two to TC Desk" "Go ahead Two" "Do you have EMS, and EMS unit available, an injured person who has some minor burns and, ah, injuries due to a falling elevator." "What's the location of that…?…A20?" (Note: The above transmissions were followed by static and mixing of radio signals.)
(FDNY Box Alarm Dispatch log and CD12/CD15)

9:28:41 10-84, Engine 44, (West and Vesey Streets, ordered to maintain street control, assisted Marine 1 with water supply)

9:28:48 10-84, Engine 47, (WTC 1, upper floors operations)

9:28:52 FDNY radio communication, PA, WTC Channel 30 repeater – "Battalion 7 Ladder One Five OV" "OV" "…?…Try to contact…The lobby, find out what bank of elevators terminates below the 75th floor. That's the bank we're gonna want to use." "10-4"

9:28:58 PAPD Police Desk radio report, PA Channel W – "TC Two. Do you have a triage area?" "Standby let me ask. Let me find out that location." "Roger, just advise when you find out where there will be a triage."

9:29 FDNY - Recall of off-duty firefighters and officers is issued (FDNY, McKinsey & Company, 2002)

9:29 (E) EMS - Casualty Collection Point (CCP) established in lobby of 3 World Financial Center at West and Vesey Streets. EMS - WTC 7 Division established (FDNY, McKinsey & Company, 2002)

9:29:11 FDNY dispatcher advises Field Comm that people are trapped in World Trade Center Building #2 on the 82nd, 83rd, and 84th floors. (FDNY World Trade Center Incident Summary notes, 2001)

9:29:15 FDNY radio communication, PA, WTC Channel 30 repeater– (Note: This exchange took place over about a 3 minute period.) "Battalion 7 to Branch Commander, Tower 2, South Tower, K" "Battalion 7 to Field Comm, K" "7 Alpha …?…Battalion 7, Orio, we're in the North Tower, Tower 2. The North Tower." "Correction, Battalion 7, it's the South Tower, Tower 1, Branch Commander, K" "…?…Battalion 7, do you want me to relay?" "Yea, Steve tell, ah, the people of Palmer we got reports of there's more planes in the area. We may have to back down here." "10-4, 7 Alpha to 7"

9:29:27 WTC Security radio report, PA Channel X – "Where are you?" "B stairway." "We're walking down from 51. We are going to do the best we can, but we do have a medical emergency. We have on individual who cannot walk down. Has asthma." "We are on the 11th floor working, working our way up."

9:30 – 9:39 About 9:30 in WTC 1, several firefighters moving up the stairwell carrying heavy equipment report chest pain. (New York Times)

9:30 a.m. An Assistant Fire Chief recalled that the WTC 1 building conditions were poor and made the decision that the building was no longer safe. (FDNY interview #2, winter 2003)

9:30:07 WTC Security radio report, PA Channel X – "S4, 63, I'm in the B stairway. Who needs help …?" "We are in B staircase, 51st floor heading down. We have two people with a medical emergency, elderly people that cannot walk down." "…?… What tower?" "That's Tower 1 staircase B." "Tower 1 staircase B. That's a copy…. Someone's in route."

9:30:19 10-84, Engine 22, (WTC 1, upper floors operations, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:30:24 WTC Security radio report, PA Channel X – "…?… to all, everybody turn your phones off …Make sure they turn off their phones off."

9:30:35	10-84, Ladder 119, (post collapse operations, operated Tower on 5 WTC) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:30:37	PAPD Police Desk radio report, PA Channel W – "A One, WTC." "A One." "Be advised EMS is setting up triage in the lobby of Building Two." "Roger. I got that." FDNY Box Alarm Dispatch log and CD12/CD15)
9:30:49	10-84, Ladder 113, (Command Post at West and Liberty Streets, on way to WTC 2 when it collapsed, then to 3 WTC)
9:30:51	10-84, Battalion Chief 41 /BC 31, (Command Post at WFC 3, Command Post at Marriott)
9:31:00	10-84, Ladder 102, (post collapse operations, evacuated Brooklyn Battery Tunnel) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:31:28	PAPD Police Desk radio report, PA Channel W – "A One, WTC." "A One." "Roger. We've received reports of, ah, people trapped in Two World Trade Center, eighty-seventh and eighty-ninth floor." "Roger, I copy where."
9:31:29	WTC Security radio report, PA Channel X – "Did you bring any of the radios for the fire commander? Did you bring any red bags with the radios for the fire department? … Did you bring" "No. Is it safe to go into the building?" I haven't returned to the building. Is it safe to go inside?"
9:31:32	FDNY radio communication, PA, WTC Channel 30 repeater – "One Five to One Five Roof" "One Five Roof" "We've got reports of another incoming plane. May have take cover. Stay in the stairwell." "10-4"
9:31:35	10-84, Engine 235, (WTC 2, operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:32	FDNY radio communications, PA, WTC Channel 30 repeater: Battalion 7 is on 55th floor of WTC 2.
9:32 a.m.	An Assistant Fire Chief is in lobby of WTC 1 makes a radio call and orders that all units come down to the lobby. (No response was received from this order, it was unheard or ignored.) (NYPD, McKinsey & Company, 2002 and FDNY Interview #2, winter 2003) Firefighter Danny Suhr is killed soon after his Brooklyn Engine Company 216 arrives at the scene, hit by a person that fell from WTC 2. (FDNY CD12/15) (New York Times, website)
9:32:01	FDNY Engine 317 states that someone from the Port Authority advises not to use the elevators on the 44th floor because they are about to come down. (FDNY World Trade Center Incident Summary notes, 2001.)
9:32:02	FDNY radio communication, PA, WTC Channel 30 repeater– "One Five to One Five Roof. That plane is ours. I repeat it's ours. What floor are you on Scotty?" "54" "Alright, keep making your way up. We're behind ya." "10-4"

9:32:05 WTC Security radio report, PA Channel X – "Don't let…Don't let no body come down … here. Back em up. Back em up. Back it up all the way up, everybody. Get everybody back." "87 to 85" "Where are … back up. …Back up. Go back … back up. All units back up."

9:32:12 WTC Security radio report, PA Channel X – "Be advised the concourse is flooding, flooding with water. There is a lot of water in the concourse." "We are aware of that. We are aware of that."

9:32:23 FDNY radio communication, PA, WTC Channel 30 repeater – "Orio" "Go ahead" "What floor should we try to get up to, Orio?" "I'm up to five, five. We need to find a …? …, a stack of elevators that terminates below the … (radio static, signal drop out)…up. K" "Below what floor?" "Below 76. The fires 78 … (radio static, signal dropout) …terminate below 76" "Alright."

9:33:02 10-84, Engine 238, (WTC 2, ordered to search upper floors, building collapsed while unit was in stairway, fatality) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:33:15 10-84, Engine 281 (FDNY Box Alarm Dispatch log and CD12/CD15)

9:34:19 10-84, Engine 216, (WTC 2, first firefighter fatality at the WTC, killed by human falling from Tower 2. The only fatality for this unit.) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:34:29 PAPD Police Desk radio report, PA Channel W – "A One, WTC" "A One" "I want all responding units to come to this desk, from the various commands to report to this desk, One World Trade Center, Fire Command Desk."

9:34:39 FDNY dispatcher lists to Field Comm the following floors in the World Trade Center Towers to check:
Building #1: 68, 82, 83, 88, 89, 92, 100, 103, 104, 105, 106
Building #2: 47, 73 west south side, 80 north west side, 82, 83 room 8300, 104 east south side, 105 east south side. (FDNY World Trade Center Incident Summary notes, 2001).

9:34:50 10-84, Engine 212, (approaching WTC 2 from CP at collapse.) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:35 FDC (NYPD, First Deputy Commissioner) orders no roof rescue to be attempted (NYPD, McKinsey & Company, 2002)

9:35:18 PAPD Police Desk radio report, PA Channel W, "TC One, Desk" "Ahead One." Please be advised from the Mayor's office. Be advised that another plane hit in this area. Copy?" (Note: There was a communication from unit 815 that immediately followed the above before the acknowledgement.) 9:35:55 – "Roger. Understand the Mayor's office; another plane is in the area."

9:37:02 PAPD Police Desk radio report, PA Channel W – "…?… AD4? …. World Trade Desk." "Go ahead." "You, ah, hear from …?… yet?" "That's a negative." "Roger, ah, try to

	find out what …?… cell phone number, beeper number is. The last I saw they were …?… three niner … ?… I didn't get the whole transmission." "Alright, Stand By.
9:37:16	10-84, Engine 214, (Command Post at WTC 2, operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:37:36	PAPD Police Desk radio report, PA Channel W – "All World Trade Center units to the Command Post All World Trade Center units evacuate everybody over the land bridge on West Street to the Financial Center. Do not. Repeat. Do not; send people out into the Concourse on the side street, on land bridge to the Financial Center."
9:39	2nd alarm for Brooklyn Battery Tunnel (FDNY, McKinsey & Company, 2002)
9:39	FDNY radio communications, PA, WTC Channel 30 repeater - Battalion 7 ten to fifteen injured civilians are being sent down to the 40th floor to be evacuated by elevator
9:39	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Squad 41 (operations unknown, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:39 (E)	WTC 2, Floor 51, Two Fire Marshals headed up the stairs after the second plane hit WTC 2 and encounter a burned survivor from the 78th floor. One Fire Marshal takes the women down, and the other Fire Marshal continues up the stairs. (New York Times, website)
	33 Manhattan firehouses responding (12 of the 33 responding with multiple units), 18 Brooklyn firehouses responding (2 of the 18 responding with multiple units) (New York Times, website, timeline)
9:39:06	FDNY radio communication, PA, WTC Channel 30 repeater – "One Five to One Five OV" "One Five OV" "Tommy, listen carefully, I'm sending all the injured down to you on the 40th. You're going to have to get them down to the, ah, to the elevator. There are about 10 to 15 people coming down to ya." "OK, 10 civilians coming down. One Five OV, I'm on the 40th right now, Lou." "Tommy, when you take people down to the lobby try to bring an EMS crew back." "Definitely."
9:39:23	10-84, Engine 201, (WTC 2, operations unknown, WTC 2 post collapse, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)
9:40 - 9:49	Chief at WTC 7 is told that WTC buildings could collapse, and he dispatches someone to tell the chiefs on West Street. (FDNY Interviews # 45 and #46, winter 2004) Another 5th alarm is broadcast. (FDNY, McKinsey & Company, 2002) Four companies dispatched to WTC 2 from the Marriott 3 WTC are led to WTC 1 by mistake. (FDNY Interviews # 47 and # 53, winter 2004)
9:40	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15) Engine 162 (post collapse operations WTC 1 and WTC 2, operations at WTC 7, hydrant at Church and Vesey Streets, stretched line to WTC 7)

9:40:12 WTC Security radio report, PA Channel X reports victims jumping from the upper floors of the buildings.

9:40:24 PAPD Police Desk radio report, PA Channel W – "Eight Hundred, World Trade" "Go ahead Eight Hundred." "Be advised, OEM is relocating out of the lobby of Building Number One over to the World Financial Center, relocating the Fire Desk."

9:40:40 PAPD Police Desk radio report, PA Channel W – "Base…?… We have the stage on fire at the main plaza. The stage is on fire on the ground level at the main plaza."

9:40:43 FDNY dispatcher advises Field Comm check World Trade Center Building #2, floors 93 and 103. FDNY World Trade Center Incident Summary notes, 2001)

9:41 FDNY radio communications, PA, WTC Channel 30 repeater - Hazmat 1 on 48th floor of WTC 2 in B stairway.

9:41 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion 32 (Command Post at West and Liberty Streets)
Engine 219 (post collapse operations, established water supply at West and Liberty Streets, stretched hoselines and extinguished ground level fires)
Engine 228/205 (responding through Brooklyn Battery Tunnel when WTC 2 collapsed)
Engine 280 (Ordered to Battery Tunnel staging area, conducted evacuation of tunnel)

9:42 FDNY radio communications, PA, WTC Channel 30 repeater: Battalion 7 is on 69th floor of WTC 2.

9:42:06 10-84, Engine 229, (at Command Post 1 WFC on West Street when WTC 2 collapsed, supplied Tower Ladder 146 and 58) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:42:39 PAPD Police Desk radio report, PA Channel W – "WTC. Be advised the triage center, according to EMS is set up in Building …?…" "Roger, copy that." "…?… four, Captain Whitaker. Be advised that the triage center is at Victoria's Secret, copy, Victoria's Secret, Building four." "A One copies where."

9:42:44 FDNY radio communication, PA, WTC Channel 30 repeater – "Battalion 9 to Battalion 7" "K, Battalion 9" "Orio, I couldn't find a bank to bring me up any higher. I'm on the 40th. What can I do for you?" "You're going to have to hoof it up. I'm on 69 now, but we need a higher bank." "What stairway you in Orio?" "Stairway B, Boy, Boy."

9:42:52 WTC Security radio report, PA Channel X – "We have people out here that want to volunteer to help. Where can I send them?" "Right now, just send everybody away from the World Trade. We are not letting anybody come close to it. So, … with that."

9:43:04 10-84, Engine 220, (Command Post West and Liberty Streets, approaching WTC 2 at collapse, extinguish fire on 9th floor of Gateway Plaza, assisted with water relay from Marine 1 to Vesey and West streets) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:43:26 WTC Security radio report, PA Channel X – "Bill, I'm at the Financial Center. I'm at the fire command station. If you want to send them over here, they have a secure hard line." "10-4"

9:44 a.m. (E) The Office of Emergency Management operations center inside WTC 7 is evacuated. (FDNY, interview 24, winter 2004)

9:44:06 10-84, Engine 41

9:44:20 WTC Security radio report, PA Channel X – "FS1, go ahead Mike." Bill have them walk across the bridge … is at the top of the bridge. He'll tell them exactly where to go." "Alright. That's a 10-4 Mike. They haven't evacuated the fire command over here." "In Building 2 or 1?" "Building 2." "That was the last word so ah we have a spot here if that's what they want to do." "10-4"

9:44:24 10-84, Battalion Chief 12, (Marriott, supervised operations at Command Post, fatalities) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:44:37 Box 0050, location of Alarm Box, West and Albany Streets (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 240
Engine 201

9:45 NYPD – Command and Control Center activated at One Police Plaza. (NYPD, McKinsey & Company, 2002)

9:45 (E) Three companies are still on 40th floor of WTC 2 evacuating civilians. (New York Times, website, timeline)

9:45:08 WTC Security radio report, PA Channel X – "This is Troy. Tell him we're sending people down evacuating on Stairway A, in A Tower, Stairway A." "Stairway A, that's a copy."

9:45:39 10-84, Ladder 104, (post collapse operations, collected BF-4 riding lists from abandoned apparatus) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:45:50 FDNY radio communication, PA, WTC Channel 30 repeater – "One five to Battalion 7" "Go ahead, One Five." "Where are ya Chief?" "74" "Ah, we're making our way behind you we took our coats off."

9:45:58 WTC Security radio report, PA Channel X – "63, this is security officer on 78 Sky Lobby" "…Where is this?" "78 Sky Lobby, 78 Sky Lobby" "That's a copy. Are you OK?" "Yes, I am. Yes I am. What do you want me to do?" "Is it possible … Copy" "Sector 4 to Evelyn" "Nancy, be advised, I have someone 1 World Trade Center 78th floor Sky Lobby. Do you Copy?" Sorry say it again." "1 World Trade Center 78th floor, windows. Do you copy?" "Is that where you're at now?" "That's a negative. I'm at Fulton and Broadway. I need someone to respond over there to ….Copy."

9:46:24 FDNY Field Comm Unit advises the FDNY Chief of Department at the WTC Incident Command Post that an additional 5th alarm is requested to respond to West and Vesey Streets. (FDNY World Trade Center Incident Summary notes, 2001)

9:46:36 Box 0050, location of Alarm Box, West and Albany Streets (FDNY Box Alarm Dispatch log and CD12/CD15)

Engine 228
Engine 219
Engine 280
Ladder 114
Ladder 113

9:47 5th alarm (FDNY, McKinsey & Company, 2002)

(FDNY Box Alarm Dispatch log and CD12/CD15)

9:47 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Battalion 21/32 (Command Post West and Liberty Streets)

9:47:00 FDNY radio communication, PA, WTC Channel 30 repeater: - "Battalion 7 to Battalion 9" "Battalion 9 to Battalion 7" "…?… These stairway walls have been compromised on 73 and 74. No smoke or fire problems, K." "OK, 10-4"

9:47:44 FDNY radio communications, PA, WTC Channel 30 repeater – "One Five to Battalion 7" "Go ahead, Ladder One Five" "What do ya got up there Chief?" "I'm standing in Boy stairway on the 74th floor, no smoke or fire problem. The walls are breached so be careful." "Yea, 10-4, I saw that on 68. We're on 71. We're coming up behind ya." "OK, …? … six more to go." "Let me know when you see fire."

9:47:50 Box 0050, location of Alarm Box, West and Albany Streets (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion Chief 32

9:47:59 PAPD Police Desk radio report, PA Channel W – "TB Four, WTC. Where's the command post? Be advised Vesey and West they can't move to the Financial Center --- …?… no condition on the street out there." "Right." "CD Four …?… (Note: Transmission was not clear.) "A One from WTC." "A One." "Roger, … ? … That's just a heavy traffic condition, it's like a parking lot on Vesey and West." "Roger, I copy."

All five FDNY rescue companies have arrived, 1 from Staten Island. Many companies are now reporting to staging areas across from the WTC. 33 Manhattan firehouses reported at the scene (12 of the 33 responding with multiple units), 22 Brooklyn firehouses with 5 of the 22 responding with multiple units, 2 Queens firehouses, 1 Bronx firehouse, and 1 Staten Island firehouse. (New York Times, website, timeline)

9:49:27 WTC Security radio report, PA Channel X – "S2, Please convey to Doug that … is on his way down." "…. Could you repeat that?" "S2 to S1 …." "George, slow down I can't understand you."…"Doug or Anesto Butcher has to talk to … Its imperative."

9:49:37 FDNY radio communication, PA, WTC Channel 30 repeater – "One Five to One Five OV" "One Five OV" "Tommy, have you made it back down to the lobby yet?" "The elevators screwed up." "You can't move it?" "I don't want to get stuck in the shaft." "Ah Tommy, its imperative that you try to get down to the lobby command post to get some people up to forty. We got injured people up here on 70. If you make it to the lobby command post, see if they can somehow get elevators past the 40th floor. We've got people injured all the way up here." "What's going on with this thing?" "Ah, go Chief" "Yea Chief, I'm on the 55th floor, got to rest. I'll try to get up there as soon as possible." "10-4"

9:49:49 10-84, Ladder 161, (post collapse operations, Staging area West and Chambers Street) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:50 FDNY radio communications, PA, WTC Channel 30 repeater: Firefighter reports to Chief that he is on the 55th floor and must stop to rest.

9:50:37 WTC Security radio report, PA Channel X – "Be advised. I've got L1 and Sector 1 one going to the hospital. Copy. So am I."

9:50:55 WTC Security radio report, PA Channel X – "S5, Fire Department needs a resuscitator, Building 1, 19th floor B corridor. (pause) "Anybody copy?" (Note: There is no response to this call.) "S5 to Command Post" "Go from Command Post" "Building 1, 19th floor resuscitation needed."

9:51:03 FDNY radio communication, PA, WTC Channel 30 repeater – "One Five to Battalion 7" "Battalion 7" "What floor you on Orio?" "Stairway on 75. Go to the South stairway and continue up." "10-4"
(FDNY Box Alarm Dispatch log and CD12/CD15)

9:51:14 10-84, Engine 240, (At staging area West and Albany Streets when WTC 2 collapsed, stretch hoselines, relayed water from Marine 1, extinguished fire at 90 West street.)
10-84, Ladder 114, (Box 0050, post collapse of WTC 2, West and Albany Streets)

9:52 NYPD radio transmission, SOD Channel, NYPD helicopters report by radio that "large pieces" are falling from WTC 2. (NYPD interviews # 21 and # 23)

9:52:11 FDNY radio communication, PA, WTC Channel 30 repeater – "Anybody see the Highway 1 car? Highway 1 car. We need it for an escort to the hospital for a fireman."

9:52:43 FDNY radio communications, PA, WTC Channel 30 repeater – "Battalion 7 to Battalion 7 Alpha" "Freddie come on over. Freddie come on over by us." "Battalion …?… We got, Ladder One Five, we've got two to three pockets of fire. We should be able to knock it down with two lines. Rad, Radi, Radio that. 78th floor, numerous 10-45 Code Ones." "What floor you on Orio?" "7 Alpha to lobby command post." "One Five to Battalion 7" "Go ahead One Five" "Chief, what stair are you in?" "South stairway Adam, South Tower" "Floor 78." "10-4, numerous civilians injured. Two engines up here." "10-4, we're on our way." (Note: 10-45 code one represents civilian fatalities)

9:53:48 FDNY radio communication, PA, WTC Channel 30 repeater – "Battalion 6, Battalion 6 reports, there's a sky lobby available at the 44th floor that will serve the floors above. Do you copy that? K"

9:53:53 WTC Security radio report, PA Channel X – "(XO ?) Martinez inside 2 World Trade Center with NYPD." "… Advise me is everyone OK and what is your 20?" Please be advised I got eighteen passengers stuck on the 78 Sky Lobby elevator trying to get them out. We need EMS over here on the double, 2 World Trade Center." "… Sky Lobby is that an elevator entrapment, sir." "That's a 10-4 the firefighter got eighteen passengers stuck. They are going to get them out, they're burned."

9:54:05 FDNY radio communications, PA, WTC Channel 30 repeater – "7 Alpha to Lobby Command Post. Chief Palmer reports on the 78th floor numerous 10-45 Code Ones. We got an isolated pocket of fire and need at least two hand lines up there. K"

9:54:29 Box 2033, location of Alarm Box, Vesey Street 100 feet West of West Street (FDNY Box Alarm Dispatch log and CD12/CD15)
Battalion 45 (Staging area at Queens Midtown Tunnel, to Command Post at West and Vesey Streets, 6 WTC post collapse operations)
Battalion 46 (Staging area at Queens Midtown Tunnel, to Command Post at West and Chambers Streets, operation at Verizon Building)
Battalion 49 (Staging area at Queens Midtown Tunnel, to Command Post at West and Vesey Streets)
Engine 294 (approaching WTC 1 when it collapsed, rescued people from 6 WTC)
Engine 258 (reported to West and Chambers Streets, in route to Command Post at West and Vesey Streets when WTC 1 collapsed)
Engine 259 (apparatus parked at West and Chambers street, in route to Command Post at West and Vesey street when WTC 1 collapsed)
Engine 260 (reporting to Command Post at West and Vesey streets when WTC 1 collapsed)
Engine 261 (reporting to Command Post at West and Vesey streets when WTC 1 collapsed)
Engine 262 (reporting to Command Post at West and Vesey streets when WTC 1 collapsed)
Engine 312 (Command Post at West and Vesey Streets when WTC 1 collapsed)
Engine 325 (post collapse operations)
Ladder 115 (Command Post at West and Vesey when WTC 1 collapsed)
Ladder 116 (Command Post at West and Vesey when WTC 1 collapsed)
Ladder 128 (Command Post at West and Vesey when WTC 1 collapsed)
Ladder 136 (Command Post at West and Vesey when WTC 1 collapsed)
Ladder 138 (Command Post at West and Vesey when WTC 1 collapsed)
Ladder 163 (Command Post at West and Vesey when WTC 1 collapsed)

9:54:40 FDNY radio communication, PA, WTC Channel 30 repeater – "Battalion 7 to Ladder One Five" "One Five" "I'm gona need your firefighters Adam stairway to knock down two fires. Get a …?… house line stretched. We can get some water on it and knock it down. K" "Alright, 10-4, were coming up the stairs. We're on 77 now on the B stair. We'll be right to ya."

9:55 FDNY radio communications, PA, WTC Channel 30 repeater: Ladder 15 is on 78th floor, in B stairway, WTC 2, "trapped in here, we've got to, ah, put some fire out to get to ya."

9:55 (E) NYPD – 40 ESU officers at Command Post (NYPD, McKinsey & Company, 2002)
2 ESU Teams in WTC 1
2 ESU Teams in WTC 2
1 ESU Team in WTC Plaza

9:55 3rd alarm dispatch staging area (FDNY, McKinsey & Company, 2002)

9:55 Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 241/224 (Command Post at West and Vesey Streets, extinguished fires on street)

Engine 246/224 (post collapse operations 5 WTC, hydrant hookup on Broadway and Church Streets, water relay to E 503, operated hoseline on street level fires at Church and Liberty Streets)
Engine 284/207 (post collapse operations, hoseline stretch from Marine 1 to Vesey Street)

9:55:46 FDNY radio communication, PA, WTC Channel 30 repeater – "One Five OV, One Five" 'Orio, we're on 78, but we're in the B stairway, trapped in here, we've got to, ah, put some fire out to get to ya."

9:55:58 Box 2033, location of Alarm Box, Vesey Street 100 feet West of West Street, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 35 (Command Post at West and Vesey Streets, 6 WTC post collapse)
Engine 50 (post collapse operations)
Engine 64
Engine 68 (post collapse operations)
Engine 83 (post collapse operations)
Engine 94 (post collapse operations)

9:55:17 10-84, Engine 228, (responding through Brooklyn Battery Tunnel when WTC 2 collapsed) (FDNY Box Alarm Dispatch log and CD12/CD15)

9:56:05 FDNY radio communication, PA, WTC Channel 30 repeater – "Fifteen Roof to Fifteen" "Go ahead Fifteen Roof" "Recommend that ya go to the South stairs, the A stairs." "Ah, 10-4, we're going to knock down some fire over here in the B stairway. We'll meet up with ya." "Get over to the A stair and help Chief Palmer." "10-4, roof"

9:56:36 WTC Security radio report, PA Channel X – "A Tower is not completely evacuated. I think they are on the way down in each stairway. People are still coming out."

9:56:55 FDNY radio communications, PA, WTC Channel 30 repeater – "Battalion 9, I need ya on the floor above 79. We have access stairs going up to 79. K" "Alright, I'm on my way up Orio."

9:57 a.m. Dozens of firefighters have gathered at the WTC 2 lobby command post awaiting orders to go up in the tower. (New York Times)

9:57:07 FDNY radio communications, PA, WTC Channel 30 repeater – "Fifteen OV to Fifteen" "Go ahead Fifteen OV, Battalion 7 Operations, Tower 1." (Note: these communications are actually in the South Tower, Tower 2) "Trapped in the elevator in the elevator shaft. Your gona have to get a different elevator. We're chopping through the wall to get out." "Radio Lobby Command with that. Tower 1."

9:57:27 WTC Security radio report, PA Channel X – "…FS2 to (90 Mike?)" "If you can copy this, I'm responding to over to A Tower Fire Command." "We are trying to get in touch with them from the 22nd floor command center, but we don't know how to operate the other set of equipment." "S2 to 77… Try to get up to the 22nd floor, A Tower command center."

9:57:51 FDNY radio communications, PA, WTC Channel 30 repeater - Amplitude of Channel 30 repeater drops to zero.

9:57:57 WTC Security radio report, PA Channel X – "…?…78 Sky Lobby, 2 World Trade Center. I got people coming out the elevator banks."

9:59 a.m. WTC 2 building collapse. (FEMA 403)

FDNY Field Com unit is destroyed (FDNY, McKinsey & Company, 2002)

West Street Incident Command Post is destroyed. FDNY, ICP personnel take shelter in nearby structures. (FDNY, McKinsey & Company, 2002)

Marriott Hotel, 3 WTC – Some firefighters in the lobby and directing evacuations on the upper floors are killed in 3 WTC when WTC 2 collapses. Others are trapped. (FDNY World Trade Center Incident Summary, 2001)

WTC 1, some firefighters up inside the building as high as the 36th floor hear an urgent order over their radios to evacuate. It is heard over the command radio channel. Multiple companies start down the stairs. (FDNY interviews #16, #39, #41, winter 2004)

33 Manhattan firehouses (12 of the 33 multiple units assigned), 27 Brooklyn firehouses (6 of 27 multiple units assigned), 2 Queens, 1 Bronx, 1 Staten Island. (New York Time, website, timeline)

9:59:51 Box 2033, location of Alarm Box, Vesey Street 100 feet West of West Street, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 84/16 (Command Post West and Vesey Street, post collapse operations)
Engine 224
Engine 231/24 (Command Post at West and Vesey Streets when WTC 1 collapsed)
Engine 271/6 (left Command Post at West and Vesey streets when WTC 1 collapsed, supplied water to standpipe Siamese at Verizon Building, extinguished fires around Verizon bldg.)
Engine 305/3 (reporting to Command Post at West and Chambers Streets when WTC 1 collapsed)
Engine 307/5 (Command Post at West and Vesey Streets when WTC 1 collapsed)
Engine 310/55 (Command Post at West and Vesey Streets, evacuated Fire Department and civilians from Command Post, WTC 1 collapsed)

10:00 NYPD – All ESU personnel ordered out of WTC buildings. (NYPD, McKinsey & Company, 2002)

10:00 10-84, Battalion Chief 46, (Staging area at Queens Midtown Tunnel, to Command Post at West and Chambers Streets, operation at Verizon Building) (FDNY Box Alarm Dispatch log and CD12/CD15)

10:00 Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, (FDNY Box Alarm Dispatch log and CD12/CD15)
Engine 14 (post collapse operation)

10:00 – 10:09 Surviving Chiefs work to recover command and additional units are arriving.

	WTC 1 - A firefighter, possibly from Ladder 3, reports over the radio a collapse on a floor in the 60's. It is the highest floor reported as being reached in the building. (New York Times, website, timeline)
10:00:52	Marine 6 reports collapse of south tower (FDNY, Manhattan Dispatch Radio Channel)
10:02:20	FDNY reports that civilian calls for assistance when he gets trapped inside a fire truck as a result of the building collapse. (FDNY World Trade Center Incident Summary notes, 2001)
10:03 (E)	EMS – Casualty Collection Point transfers to lobby of the Embassy Suites at North End and Vesey Streets. (FDNY, McKinsey & Company, 2002)
10:04 (E)	EMS – Primary staging area is designated at West and Chambers Streets. (FDNY, McKinsey & Company, 2002)
10:06	Box 0320, (FDNY Box Alarm Dispatch log and CD12/CD15) Engine 160 (post collapse operations, supplied water to two Tower Ladders operating on WTC 7)
10:06	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, (FDNY Box Alarm Dispatch log and CD12/CD15) Ladder 78 (post collapse operations, Command Post at Broadway and Vesey Streets, extinguish street level fires on Broadway, supply water to Tower Ladder 15 on Liberty Street)
10:06:01	10-84, Engine 271/E 6, (left Command Post at West and Vesey streets when WTC 1 collapsed, supplied water to standpipe Siamese at Verizon Building, extinguished fires around Verizon bldg.) (FDNY Box Alarm Dispatch log and CD12/CD15)
10:06:04	10-84, Engine 282, (stretched and operated hoselines to extinguish debris fires) (FDNY Box Alarm Dispatch log and CD 12/CD15)
10:06:05	Second Notification 4. Police operations 212-37 (FDNY Box Alarm Dispatch log)
10:07	Mutual aid requested from Westchester County. (FDNY, McKinsey & Company)
10:07 a.m.	NYPD helicopters hovering near WTC 1 to check its condition radios, "About 15 floors down from the top, it looks like its glowing red." Aviation 14, radioed at 10:07 a.m. "It's inevitable." Seconds later, another pilot (Aviation 6) reported: "I don't think this has too much longer to go. I would evacuate all people within the area of that second building." (New York Times)
	NYPD helicopters: Aviation 6 warns that WTC 1 collapse is likely, and advises immediate evacuation. (NYPD, McKinsey & Company)
	34 Manhattan firehouses (12 of the 34 reporting multiple units), 28 Brooklyn firehouses (6 of 28 reporting multiple units), 5 Queens firehouses, 1 Bronx firehouse, 1 Staten Island firehouse. (New York Times, website, timeline)

10:07:39	10-84, Engine 284, (post collapse operations, hoseline stretch from Marine 1 to Vesey Street)
10:08	Box 9998, location of Alarm Box, WTC special box assignment for the attack Ladder 124/5 (post collapse operations)
10:08	NYPD – Chief of Department orders that no traffic is allowed to enter Manhattan. (NYPD, McKinsey & Company)
10:08:25	Box 0031-3, location of Alarm Box, Broad and Beaver Streets, Explosion smoke in clinic-1. Engine 14 Ladder 17 Records show no 10-84 for these units arriving at Box. The next record for the units after they acknowledge the assignment messages are 10:58:34 for Ladder 17 and 14:40:21 for Engine 14 indicating that they are available.
10:09	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 227 (Command Post at Broadway and Vesey Streets, post collapse operations)
10:09:06	10-84, Engine 84 /E 16, (Command Post West and Vesey Street, post collapse operations)
10:09:13	10-84, Engine 249, (post collapse operations, victim rescue and fires extinguished using hand extinguishers)
10:09:16	10-84, Battalion Chief 46, (Staging area at Queen Midtown Tunnel, to Command Post at West and Chambers Streets, operations at Verizon Building)
10:09:21	10-84, Battalion Chief 45, (Staging area at Queens Midtown Tunnel, to Command Post at West and Vesey Streets, 6 WTC post collapse operations)
10:09:22	Box 0050, location of Alarm Box, West and Albany Streets Ladder 43 (post collapse operations, WTC 1 stairway B)
10:09:29	10-84, Ladder 116, (Command Post at West and Vesey when WTC 1 collapsed)
10:10 –10:19	Fire Chiefs in front of Marriott 3 WTC work to reestablish operations. Surviving firefighters in 3 WTC try to find their way down from upper floors while others try to free people trapped in the lobby. (New York Times, website, timeline)
10:10:33	10-84, Ladder 136, (Command Post at West and Vesey when WTC 1 collapsed)
10:10:58	10-84, Engine 262, (reporting to Command Post at West and Vesey streets when WTC 1 collapsed)
10:11:38	10-84, Ladder 138, (Command Post at West and Vesey when WTC 1 collapsed)
10:11:42	10-84, Engine 35, (Command Post at West and Vesey Streets, 6 WTC post collapse)

10:12	NYPD – All emergency vehicles are ordered to pull back to Vesey and West Streets. (NYPD, McKinsey & Company)
10:12	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 518 (post collapse operations, stretched hoselines and operated in WTC 7) Ladder 148 (post collapse Command Post operations, Broadway and Vesey streets)
10:12:04	Box 0019-1, location of Alarm Box, 17 Battery PL, West and Washington Streets, Elevator Shaft Fire Engine 202 Ladder 59
10:12:18	Box 8000-1, location of Alarm Box, St. George Ferry Terminal U/L Opp Pbserv Tower Engine 164 Engine 157 Engine 156 Engine 166 Engine 155 Engine 162 Ladder 84 Ladder 83 Ladder 85 Marine 9
10:13:07	Box 0080-5, location of Alarm Box, Nassau and Fulton Streets, Smoke in Store Engine 236 Ladder 47
10:13:14	10-84, Engine 94, (post collapse operations)
10:13:31	Box 0053-2, location of Alarm Box Trinity and Cedar Streets, Trapper Engine 210 Ladder 58 /L 20
10:14:02	10-84, Engine 305/E3, (reporting to Command Post at West and Chambers Streets when WTC 1 collapsed)
10:14:55	10-84, Engine 64
10:15	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Engine 236/15 (responding to scene when WTC 1 collapsed, stretched handlines from building standpipes and extinguished street level fires)
10:15 (E)	WTC 1 floor 19 – Evacuating firefighters and other witnesses find a large group of firefighters in no apparent hurry to get out. (New York Times, website, timeline)
	Units from the outer northern boroughs arrive at the scene and escape having casualties. They are the first to search for survivors. 35 Manhattan firehouses (13 of the 35 reporting multiple units), 28 Brooklyn (6 of 28 reporting multiple units), 7 Queens firehouses, 6 Bronx firehouses (1 of the 6 reporting multiple units), 1 Staten Island firehouse. (New York Times, website, timeline)

10:15:03 10-84, Ladder 43, (post collapse operations, WTC 1 stairway B)

10:15:12 10-84, Engine 83, (post collapse operations)

10:15:13 10-84, Engine 68, (post collapse operations)

10:15:25 10-84, Engine 276 /E211,

10:18:42 10-84, Engine 50, (post collapse operations)

10:19:35 FDNY dispatcher advises Engine 228 acting that a firefighter is trapped in the Marriot, bell area. (FDNY World Trade Center Incident Summary notes)

10:19:56 Box 0064-1, location of Alarm Box, Greenwich and Liberty Streets, Deutsche Bank on 22 Floor – Floor Fell
Engine 309 /E 33
Ladder 146 /L 11

10:20 – 10:29 A few companies reach the WTC 1 lobby where they find destruction. Some companies are delayed. Firefighters climb into the Marriott Hotel 3 WTC to answer Mayday calls from trapped personnel. (New York Times, website, timeline)

10:20 NYPD – Aviation 14 states the WTC 1 is leaning. (NYPD, McKinsey & Company)

10:20 Box 9998, location of Alarm Box, WTC special box assignment for the attack
Ladder 58/20 (Arrived at Cedar and Church Streets, WTC 1 collapsed)

10:21:28 10-84, Ladder 148, (post collapse Command Post operations, Broadway and Vesey streets)

10:21:50 10-84, Ladder 47, 10-33 odor of smoke

10:22 Recalled firefighters arriving with assigned units

10:22:18 10-84, Engine 160, (post collapse operations, supplied water to two Tower Ladders operating on WTC 7)

10:23 Mutual aid request issued to Nassau County with directions on staging areas. (FDNY, McKinsey & Company)

10:23:36 10-84, Engine 246 /E235, (post collapse operations 5 WTC, hydrant hookup on Broadway and Church Streets, water relay to E 503, operated hoseline on street level fires at Church and Liberty Streets)

10:24 a.m. Dozens of people trapped in a stairway in WTC 1 on and above the third floor were directed out by a firefighter that had broken through an office wall with an ax. The firefighter opened a hole through the wall to the mezzanine and the street. He lighted the path with his flashlight. He stayed behind to direct others out of the building and did not exit with people that had been trapped. (New York Times interview with Ms. Susan Frederick. “9/11 Exposed Deadly Flaws in Rescue Plan”)

	Final count of firehouse units reporting before the WTC 1 collapse: 35 Manhattan firehouses (13 of the 35 reporting multiple units), 30 Brooklyn (6 of 30 reporting multiple units), 7 Queens firehouses, 7 Bronx firehouses (1 of the 7 reporting multiple units), 1 Staten Island firehouse. (New York Times, website, timeline)
10:24	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 247 (Command Post at Broadway and Vesey Streets, post collapse operations, hydrant hookup and supply of hoselines to Tower Ladders) Engine 318/279 (post collapse operations, Staging area at West and Chambers Streets, hose stretch from Marine 1 to Vesey Street) Ladder 107/105 (post collapse operations)
10:24:26	Box 0063-7, Broadway and Liberty Streets, People trapped in basement. Engine 61 /E 18 Ladder 3
10:26:29	Marine 9, Acknowledged MDT, (tied up at Vesey and Hudson River, drafted water, supplied numerous 3 ½ inch hoselines to relaying pumpers, tower ladders and manifolds)
10:27	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Battalion 58 (Coordinated staging area at Brooklyn Bridge)
10:27:11	10-84, Engine 227, (Command Post at Broadway and Vesey Streets, post collapse operations)
10:28:02	10-84, Ladder 78, (post collapse operations, Command Post at Broadway and Vesey Streets, extinguish street level fires on Broadway, supply water to Tower Ladder 15 on Liberty Street)
10:28:11	10-84, Engine 236, 10-33 odor of smoke
10:28:16	10-84, Ladder 58 /L 20, (Arrived at Cedar and Church Streets, WTC 1 collapsed)
10:29 a.m.	WTC 1 building collapse. (FEMA, 403)
10:30	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Squad 61 (searched subway station at Church Street (#1Line), searched 5 WTC found one victim and removed to EMS, searched 130 Liberty Street and debris area.
10:30:08	10-84, Engine 318 /E279, (post collapse operations, Staging area at West and Chambers Streets, hose stretch from Marine 1 to Vesey Street)
10:30:30	Engine 289 reports major collapse of both towers.
10:32:12	10-84, Engine 228, (responding through Brooklyn Battery Tunnel when WTC 2 collapsed)
10:32:30	10-84, Engine 247 /E240, (Command Post at Broadway and Vesey Streets, post collapse operations, hydrant hookup and supply of hoselines to Tower Ladders)

10:33:20	10-84, Ladder 85 (post collapse operations, Command Post at Broadway and Vesey, operated Tower Ladder between 4 and 5 WTC)
10:33:56	10-84, Engine 155, (search of 5 WTC, supplied hose lines to debris pile of WTC 2, hooded up of serviceable hydrant at Church and Murray Streets and relayed water to E 229)
10:35	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 290 (search of debris piles)
10:37	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 254 (reported to Command Post at West and Chambers Streets, search collapse area) Ladder 153 (reported to Command Post at Broadway and Vesey Streets, searched 5 WTC, buildings on Liberty Street and debris pile, setup Tower Ladder stream on fire at Bankers Trust Building)
10:38	EMS – Brooklyn Bridge Division established and Brooklyn Bridge Casualty Collection Point established. (FDNY, McKinsey & Company)
10:38:32	10-84, Engine 309 /E 33, (reported to Command Post at West and Liberty Streets, stretched 3 ½ inch hoselines from command post to Marine Companies at pier, stretched supply lines from Marine 2 to E 209 and E 279, stretched supply lines to manifolds and Tower Ladders, searched collapse area)
10:40 (E)	EMS – Staging and treatment area established at Harrison and Greenwich Streets. (FDNY, McKinsey & Company)
10:42:51	10-84, Engine 157 (Command Post at West Street, stretch hoseline, fight street fires)
10:45	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 514 (hooked up to hydrant in front of 80 West Street, stretched 3 ½ inch supply line to Tower Ladder 114 in front of 90 West Street, supplied water to Tower Ladder 15 in front of 90 West Street, supplied water to standpipe of 85 West Street, searched collapse area)
10:45 (E)	FDNY Chief arrives at One Police Plaza Command and Control Center. (FDNY, McKinsey & Company)
10:46:09	10-84, Battalion Chief 58, (Coordinated staging area at Brooklyn Bridge)
10:48:26	FDNY Engine 24 calls “Mayday” two members trapped in the promenade. (FDNY World Trade Center Incident Summary notes)
10:49	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Engine 309/33 (reported to Command Post at West and Liberty Streets, stretched 3 ½ inch hoselines from command post to Marine Companies at pier, stretched supply lines from Marine 2 to E 209 and E 279, stretched supply lines to manifolds and Tower Ladders, searched collapse area)

10:50	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 206 (hooked to serviceable hydrant at Nassau and John Streets, relayed water to E 221 that was supplying a Tower Ladder, stretched and operated hoselines at Liberty Street debris fires)
10:50:50	FDNY Engine 33 advises that the water pressure is lost in lower Manhattan and requests a fireboat to augment the water supply. (FDNY World Trade Center Incident Summary notes)
10:50:56	10-84, Engine 61/E 18
10:51:36	Box 2033, location of Alarm Box, Vesey Street 100 feet West of West Street-1, Marine 4
10:52:17	Marine 4 Acknowledged RSEP
10:52:17	10-84, Engine 290
10:52:24	10-84, Ladder 83 (post collapse operations, Command Post at West and Chambers Streets, stretched hoselines at various fires, search debris piles)
10:52:02	Box 0064-8, location of Alarm Box, Greenwich and Liberty Streets, People Buried Engine 286/E 10
10:53:52	FDNY personnel request help to rescue civilians trapped, also FDNY members appear to be trapped on the West South of Tower #1. (FDNY World Trade Center Incident Summary notes)
10:54:58	10-84, Engine 166
10:55	Box 1377, location of Alarm Box, Columbia and Woodhull Streets, Engine 248 (reported to Command Post at Broadway and Vesey Streets, assisted Field communications by laying out phone lines between command posts, search of buildings)
10:59 (E)	EMS – Dispatch is unable to contact chiefs. (FDNY, McKinsey & Company) Division 2 Deputy Chief prepared to assume command at Brooklyn Bridge
11:00 (E)	EMS established liaison at new Incident Command Post at West and Chambers Streets. (FDNY, McKinsey & Company)
11:00	NYPD – 9-1-1 calls rerouted through backup emergency call network
11:00	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Squad 270 (searched collapse area)
11:10:21	10-84, Engine 206, (hooked to serviceable hydrant at Nassau and John Streets, relayed water to E 221 that was supplying a Tower Ladder, stretched and operated hoselines at Liberty Street debris fires)
11:11:02	Box 0320-1, location of Alarm Box, Brooklyn Bridge Engine 227

Engine 276/E 211
Engine 241/E 224
Engine 249
Engine 282/E 204 (stretched and operated hoselines to extinguish debris fires)
Engine 284/E 207

11:11:33 10-84, Engine 276/E 211

11:12:38 10-84, Engine 248, (reported to Command Post at Broadway and Vesey Streets, assisted Field communications by laying out phone lines between command posts, search of buildings)

11:13:28 Box 0320-1, location of Alarm Box Brooklyn Bridge
Engine 515
Engine 246/E 235
Engine 519
Battalion Chief 41/BC 31
Battalion Chief 42/BC 32
Ladder 148
Ladder 119

11:13:51 10-84, Engine 515, (reported to Command Post at Broadway and Vesey Streets, stretched hoselines and conducted operations at 3 WTC, Marriott, conducted search of collapse area)

11:15 (E) Assistant Chief of EMS Ops and Tour 1 EMS Chief are in route to One Police Plaza to establish inter-agency communications.

11:16:52 Box 0320-1, location of Alarm Box, Brooklyn Bridge
Engine 152
Engine 160
Ladder 78

11:19 Box 0320,
Engine 155 (search of 5 WTC, supplied hose lines to debris pile of WTC 2, hooded up to serviceable hydrant at Church and Murray Streets and relayed water to E 229)
Engine 156 (reported to Command Post on Broadway and Vesey Streets, search building at Liberty and West Streets, supplied hoselines, and supplied water to Tower Ladder 84
Engine 164 (search of building on Liberty Street, searched debris pile)
Ladder 84 (reported to Command Post at Broadway and Vesey Streets, search of 5 WTC, operated Tower Ladder at Church and Vesey Streets on 5 WTC and WTC 7

11:21 EMS – Forward staging area established at West and Chambers Streets. (FDNY, McKinsey & Company)

11:25 Box 1377, location of Alarm Box, Columbia and Woodhull Streets,
Battalion 37 (reported to staging area at Brooklyn Bridge, operated Command Post at Broadway and Vesey Streets)

11:30 (E) NYPD – Chief of Department returns to One Police Plaza. (NYPD, McKinsey & Company)

11:30 (E)	EMS presence established at One Police Plaza. (FDNY, McKinsey & Company)
11:38	Recalled firefighters on city buses awaiting deployment. (FDNY, McKinsey & Company)
11:42	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Ladder 47/6 (search and rescue operations, standpipe hookups and stretch hoselines
11:48	EMS – contact between One Police Plaza and dispatch established. (FDNY, McKinsey & Company)
11:50	EMS – New Jersey side ferry terminal staging and treatment area established. (FDNY, McKinsey & Company)
11:58	EMS Command conducts roll call for chief location and sector operations. (FDNY, McKinsey & Company)
12:00	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Engine 321 (supplied building Siamese at 130 Greenwich Street, supplied and operated multiversal on debris, search operations)
12:05	NYPD – Verizon building at 140 West Street flooded
12:07	EMS – West Broadway and Chambers Street staging area is moved to Chelsea and Piers Division as a result of a gas leak. (FDNY, McKinsey & Company)
12:10 (E)	EMS three new locations for Casualty Collection Points: Javits Center, Brooklyn Navy Yard, and the Yankees minor league stadium at Staten Island. (FDNY, McKinsey & Company)
12:15 (E)	EMS resources staged at Broadway and Reade Streets with 100 Academy personnel. (FDNY, McKinsey & Company)
12:26:13	10-84, Ladder 7, (WTC 2, operations unknown, fatalities)
1:04:54	10-84, FDNY? FC Field Com 1
1:29	Box 9998, location of Alarm Box, WTC special box assignment for the attack Ladder 17/15 (Tower Ladder stream into 4 and 5 WTC
1:29:53	Battalion Chief 37 reports that eight bus loads of firefighters are located at the Manhattan Bridge
1:30	NYPD – Communications Division switches to emergency control stations
1:40	Box 0300, Engine 153 (stretched and operated hoselines at fires on Liberty Street, supplied Tower Ladder 79)

1:46:25	Battalion Chief 32 reports from Manhattan Bridge that busses are over Bridge to staging area at City Hall Park
2:00	Division 3 Chief assumes EMS command at West and Chambers Streets
2:00	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Ladder 117/3 (assisted with hoseline stretches and searched for victims)
2:02	Box 9998, location of Alarm Box, WTC special box assignment for the attack Battalion 26/7 (search and extinguish pockets of fire)
2:09:47	Box 0050, location of Alarm Box, West and Albany Streets Engine 210 Engine 202
2:18:11	Box 2023, location of Alarm Box, Rector PL and South End Ave, Ladder 135/L 5
2:45 (E)	NYPD – Verizon provides portable cellular units. (NYPD, McKinsey & Company)
2:45:36	10-84, Ladder 135/L 5, (reported to Command Post at West and Liberty Streets operated Tower Ladder on debris piles and 90 West Street)
2:49:11	Box 2023-1, location of Alarm Box, Rector PL and South End Ave Ladder 146/L 11
2:55:44	Box 0050, location of Alarm Box, West and Albany Streets Engine 252
3:09	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Ladder 79/131 (operated tower Ladder at Greenwich and Liberty Streets, search of debris pile)
3:16:20	Box 2023-1, location of Alarm Box, Rector PL and South End Ave Ladder 117/L 3
3:17:36	10-84, Engine 230, (Command Post at West and Liberty Streets, operations unknown, fatalities)
3:20:52	10-84, Engine 236/E15, (responding to scene when WTC 1 collapsed, stretched handlines from building standpipes and extinguished street level fires)
3:44:53	10-84, Ladder 117/L 3, (assisted with hoseline stretches and searched for victims)
3:53	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Engine 511/6 (members responded to recall and manned a reserve apparatus, stretched 3 ½ inch supply line from Liberty and Church Streets to Liberty and Nassau Streets and hooked up to hydrant and supplied water to the site, searched the collapse area)
4:00 (E)	NYPD – Verizon facility at 140 West Street fails due to flooding. (NYPD, McKinsey & Company)

4:46:31	10-84, Battalion Chief 32, (Command Post at West and Liberty Streets)
5:00	Box 8087, location of Alarm Box, WTC 2 lobby at Command Desk, Ladder 165/18 (reported to West and Vesey Street Command Post, operated at N.Y. Telephone Building basement fire)
5:20:33	WTC 7 building begins to collapse. (FEMA 403)
5:21:10 p.m.	WTC 7 building complete collapse. (FEMA 403)
5:21:11	FDNY Field Comm 1 reports major collapse of World Trade Center Building #7. (FDNY World Trade Center Incident Summary notes)

Chronology Reference Documents:

Federal Emergency Management Agency, *World Trade Center Building Performance Study: Data Collection, Preliminary Observations, and Recommendations,* FEMA 403, Federal Insurance and Mitigation Administration, Washington, DC, May 2002.

Fire Department City of New York, List of Box Alarms for the World Trade Center on September 11, 2001. The record includes: Box Alarm Location, Unit ID and Assignment Time, Unit ID and Arrival Time.

Fire Department City of New York, Compilation of Unit CD 12/CD 15 Forms on File with FDNY, records include Unit ID, Responded to Box/Time, and Names of Deceased per Unit.

McKinsey & Company, Fire Department City of New York, *Increasing FDNY's Preparedness,* August, 2002.

McKinsey & Company, New York Police Department, *Improving NYPD Emergency Preparedness and Response,* August 2002.

Port Authority of New York and New Jersey, Tape of FDNY Channel 30 Repeater, World Trade Center (Citywide in-building) from 08:45 until 09:58.

Port Authority of New York and New Jersey, Tape of WTC Police Desk #1, Channels 002 – 039, from 07:05 until 09:56.

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Attachment 3
LISTING OF PORT AUTHORITY, NYPD, AND FDNY COMMUNICATIONS

Port Authority, NYPD and FDNY Communications

The NIST received duplicates of many radio and telephone channels. The tapes listed below cover a wide range of times. All recordings cover at least from 8:45 a.m. to 9:58 a.m. The remainder of the communications can be placed in two categories as follows; 7:05 a.m. to 9:58 a.m. and 7:05 a.m. to 6:00 p.m.

Central Police Desk - Police Command Ch 2 to 39 – Each one of these recordings is 198 minutes long.

CPD Ch. 002 - CPD.wav Not assigned
CPD Ch. 003 - CPD.wav Not assigned
CPD Ch. 004 - CPD.wav Not assigned
CPD Ch. 005 - CPD.wav Not assigned
CPD Ch. 006 - CPD.wav Not assigned
CPD Ch. 007 - CPD.wav Not assigned
CPD Ch. 008 - CPD.wav Not assigned
CPD Ch. 009 - CPD.wav Not assigned
CPD Ch. 010 - CPD.wav Not assigned
CPD Ch. 011 - CPD.wav Not assigned
CPD Ch. 012 - CPD.wav Not assigned
CPD Ch. 013 - CPD.wav Not assigned
CPD Ch. 014 - CPD.wav Not assigned
CPD Ch. 015 - SPEN 1 State Police Emergency Network.wma
CPD Ch. 016 - Radio SPEN 2 State Police Emergency Network.wma
CPD Ch. 017 - Radio (Ch. A) PA Area Wide.wma
CPD Ch. 018 - Radio (Ch. W) LT Police.wma
CPD Ch. 019 - CPD.wav Not assigned
CPD Ch. 020 - CPD.wav Not assigned
CPD Ch. 021 - Phone 911 Emergency.wma (note: recording was blank)
CPD Ch. 022 - Phone 911 Emergency.wma (note: recording was blank)
CPD Ch. 023 - Phone SGT's Desk - 201-216-6800.wma
CPD Ch. 024 - Phone Clerk - 201-216-6800.wma
CPD Ch. 025 - Phone TTY NY- 201-216-6800.wma
CPD Ch. 026 - Phone Clerk Extra - 201-216-6800.wma
CPD Ch. 027 - Phone TTY NJ - 201-216-6800.wma
CPD Ch. 028 - Phone Absence Control Line 1 - 201-216-6988.wma
CPD Ch. 029 - Phone Absence Control Line 2 - 201-133-6988.wma
CPD Ch. 030 - Phone 800 number SGT's Desk - 201-216-6858.wma
CPD Ch. 031 - Desk TTY number 3.wma
CPD Ch. 032 - CPD.wav Not assigned
CPD Ch. 033 - CPD.wav Not assigned
CPD Ch. 034 - CPD.wav Not assigned

CPD Ch. 035 - Phone 201-963-7247 Assignment Line 800-776-8580.wma
CPD Ch. 036 - Phone 201-963-7248 Assignment Line 800-776-8580.wma
CPD Ch. 037 - Phone 201-963-7249 Assignment Line 800-776-8580.wma
CPD Ch. 038 - Phone 201-659-3028 Toll Rob 800-TOLL-ROB.wma
CPD Ch. 039 - Phone 201-216-6794 Drug Tip 800-828-PAPD.wma

PATH Police Command - Ch 02 to 31 – Recordings vary in length from 106 minutes to 193 minutes.

PATH Ch. 02 - Phone Desk Right.wma
PATH Ch. 03
PATH Ch. 04
PATH Ch. 05
PATH Ch. 06 - SGT. desk.wma
PATH Ch. 07 - Tour Commander.wma
PATH Ch. 08 - Report Room.wma
PATH Ch. 09 - Juvenile Room.wma
PATH Ch. 10 - Reserve Room 216-6078.wma
PATH Ch. 11 - Phone Desk Left.wma
PATH Ch. 12 - Jersey City Fire Department.wma
PATH Ch. 13 - Jersey City Medical Center.wma
PATH Ch. 14 - Jersey City Police.wma
PATH Ch. 15 - NYPD.wma
PATH Ch. 16
PATH Ch. 17
PATH Ch. 18
PATH Ch. 19 - Conference Room 1.wma
PATH Ch. 20 - Conference Room 2.wma
PATH Ch. 21 - Radio (R2) Train Master.wma
PATH Ch. 22 - PD Wall (Desk Area).wma
PATH Ch. 23 - Court Office 1.wma
PATH Ch. 24 - Court Office 2.wma
PATH Ch. 25 - Court Sgt.wma
PATH Ch. 26 - Radio (R1) Train Master.wma
PATH Ch. 27 - Radio (R30) Communications.wma
PATH Ch. 28
PATH Ch. 29
PATH Ch. 30
PATH Ch. 31

WTC Police Desk 1 - Ch 002 to 039 – Each one of these recordings is 171 minutes.

Ch. 00WTC 2.wav
Ch. 003 WTC.wav
Ch. 004 WTC.wav
Ch. 005 WTC phone 435-8456 clerk.wav
Ch. 006 WTC phone 435-8462 clerk.wav
Ch. 00WTC 7 phone 435-2135 TC.wav
Ch. 008 WTC phone 435-3541 desk left.wav
Ch. 009 WTC phone 435-3541 desk center.wav

Ch. 010 WTC phone 435-3541 desk right.wav
Ch. 01WTC 1 phone 435-8460 conf. room.wav
Ch. 01WTC 2.wav
Ch. 013 WTC phone 435-3519 office.wav
Ch. 014 WTC direct line FDNY.wav
Ch. 015 WTC direct line NYC EMS.wav
Ch. 016 WTC phone 435-7666 floor warden.wav
Ch. 01WTC 7 direct line fire command WTC 1.wav
Ch. 018 WTC direct line fire command WTC 2.wav
Ch. 019 WTC.wav
Ch. 020 WTC.wav
Ch. 02WTC 1 phone 435-2133 police reserve rm..wav
Ch. 02WTC 2 phone 435-2131 SHO desk.wav
Ch. 023 WTC phone 435-2948 desk.wav
Ch. 024 WTC radio Ch. A.wav
Ch. 025 WTC radio Ch. B.wav
Ch. 026 WTC radio Ch. W.wav
Ch. 02WTC 7 radio Ch. X.wav
Ch. 028 WTC radio Ch. Y.wav
Ch. 029 WTC radio Ch. Z.wav
Ch. 030 WTC FDNY radio.wav
Ch. 03WTC 1.wav
Ch. 03WTC 2.wav
Ch. 033 WTC.wav
Ch. 034 WTC.wav
Ch. 035 WTC.wav
Ch. 036 WTC.wav
Ch. 03WTC 7.wav
Ch. 038 WTC.wav
Ch. 039 WTC.wav

Newark International Airport - Police Command - Ch 02 to 39

EWR Ch. 002
EWR Ch. 003
EWR Ch. 004
EWR Ch. 005
EWR Ch. 006
EWR Ch. 007
EWR Ch. 008 - Phone 733-7525 - Newark PD.wma
EWR Ch. 009 - Phone PL234846 - Eliz PD.wma
EWR Ch. 010 - Phone PL92866- Newark FD.wma
EWR Ch. 011 - PL234881 - Eliz FD.wma
EWR Ch. 012 - Phone PL230333 - AFA.wma
EWR Ch. 013
EWR Ch. 014 - Phone PL234979 - REMCS.wma
EWR Ch. 015 - FAA Tower Crash Alarm.wma
EWR Ch. 016
EWR Ch. 017
EWR Ch. 018 - PNPD PVL - OSNA660-650.wma

EWR Ch. 019 - Phone 589-6321 - PNPD.wma
EWR Ch. 020 - Phone 589-0292 - PNPD.wma
EWR Ch. 021 - Phone 961-6666 - Line 3.wma
EWR Ch. 022 - Phone 961-6666 - Line 4.wma
EWR Ch. 023 - Radio - EWR Command - 800Mhz.wma
EWR Ch. 024 - Radio - EWR ARFF - 800Mhz.wma
EWR Ch. 025 - Radio - EWR TAC 1 - 800Mhz.wma
EWR Ch. 026 - Radio - Central Police Desk - 800Mhz.wma
EWR Ch. 027 - Radio - EWR Detectives.wma
EWR Ch. 028 - Police Desk left phone - 961-6230.wma
EWR Ch. 029 - Police desk phone center - 961-6230.wma
EWR Ch. 030 - Police CAD desk phone - 961-6230.wma
EWR Ch. 031 - Police Desk right phone - 961-6230.wma
EWR Ch. 032 - Phone 961-6666 - Line 2.wma
EWR Ch. 033 - Phone 961-6666 - Line 1.wma
EWR Ch. 034
EWR Ch. 035
EWR Ch. 036 - Radio Ch. Z - Operations & Terminals.wma
EWR Ch. 037
EWR Ch. 038 - Radio - Ch. X - Facility Maintenance.wma
EWR Ch. 039 - Radio - Ch. B - Maintenance.wma

NYPD WTC Communications

NYPD Special Operations Division (SOD), Tape 1, 08:46 – 09:33
NYPD Special Operations Division (SOD), Tape 2, 09:32 – 10:18
NYPD Special Operations Division (SOD), Tape 3, 10:18 – 11:04

NYPD City wide 1 radio, Tape 4, 08:40 – 09:27
NYPD City wide 1 radio, Tape 4b, 09:27 - 10:12
NYPD City wide 1 radio, Tape 5c, 10:12 - 11.59
NYPD City wide 1 radio, Tape 5d, 10:59 – 11:46

NYPD Division 1, Tape 6, 08:45 – 9:30
NYPD Division 1, Tape 7, 09:29 – 10:15
NYPD Division 1, Tape 8, 10:14 - 11:00

FDNY WTC Communications

FDNY Manhattan dispatch channel, 154.25 MHz

Appendix A
INCIDENT COMMAND SYSTEM

DCN: 1.05.13

Appendix A
Incident Command System
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INCIDENT COMMAND SYSTEM MANUAL

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(Not published)

PART 4 ICS POSITION GUIDES

PART 5 EMERGENCY RESPONSE PLANS AND CHECKLISTS

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FDNY INCIDENT COMMAND SYSTEM

Appendix A
Incident Command System
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1. POLICY

1.1 To provide guidelines and concepts to manage an incident in an efficient organized manner, this document describes the components, operating capabilities and functions of the **New York City Fire Department Incident Command System (ICS).**

1.2 The **Incident Command System** will improve firefighter safety by providing better accountability of personnel and improved use of resources and tactical effectiveness.

1.3 This part of the document includes a general description of the organizational structure. Descriptions of the duties and responsibilities for each position at various types of incidents appear in other portions of the ICS document.

1.4 The FDNY-ICS breaks down the elements that are required to successfully manage an incident into 5 main functions. The functions are: COMMAND, PLANNING, OPERATIONS, LOGISTICS, and FINANCE.

1.5 It is the responsibility of the initial Incident Commander, whether a Company Officer or a Chief, to implement the necessary functions within this System based on the needs of the incident. As the needs of the incident grow in complexity and the Command function is transferred to succeeding officers, further expansion of the ICS should take place.

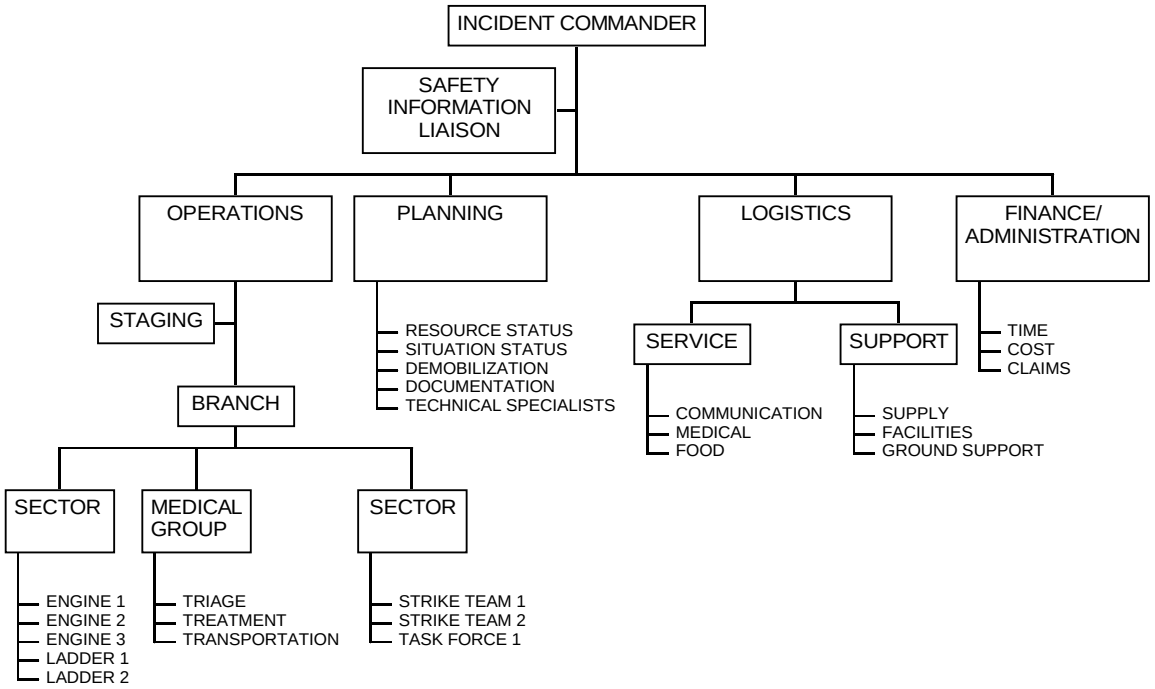
1.6 The FDNY INCIDENT COMMAND SYSTEM is the official policy for the management of all incidents and the development of standard operating procedures.

The Department will implement the system at all incidents for which it has management responsibility.

1.7 The charts depicted in this document describe the standard ICS designation, level of responsibility and hierarchy of reporting responsibility within the system.

The following chart indicates the various ICS positions within the system. It depicts management responsibility for reporting and levels of authority for issuing orders. The vertical structure of the system does not show the horizontal communication between the various functions for purposes of coordination and safety. Actions, conditions, or deployment of resources that affect or alter the strategy or tactics of the IC must be reported to the next higher level of command.

FDNY INCIDENT COMMAND SYSTEM MODEL



2. CAPABILITIES

2.1 The New York City Fire Department Incident Command System provides for the following kinds of operations:

A. Single jurisdiction and single agency.

B. Single jurisdiction and multi-agency.

C. Multi-jurisdiction and multi-agency involvement.

2.2 This organizational structure is capable of adapting to any type or size incident to which the department responds. The system effectively utilizes existing technology and is adaptable to new technology that may become available. It expands in a logical manner based on the needs of the incident, from the initial response to a major incident.

2.3 The System provides basic elements in organization, standard terminology and procedures that ensure efficient operations by trained personnel. It can be implemented with a minimum of disruption to existing procedures and provides the means for adding or subtracting resources in a cost-efficient and effective manner. As the incident grows the IC can staff positions that will focus on specific functional responsibilities to assist in managing the incident. As the incident de-escalates, the organization structure can be reduced.

3. CHARACTERISTICS

The ICS has several characteristics or components. These components interact to create a system that ensures optimum information management and control under normal or crisis conditions. The characteristics are:

- **COMMON TERMINOLOGY**
- **MANAGEABLE SPAN OF CONTROL**
- **MODULAR ORGANIZATION**
- **INTEGRATED COMMUNICATIONS**
- **UNIFIED COMMAND STRUCTURE**
- **INCIDENT ACTION PLANNING**
- **DESIGNATED INCIDENT FACILITIES**
- **RESOURCE MANAGEMENT**

3.1 COMMON TERMINOLOGY

3.1.1 The use of common terminology insures that all members are able to communicate effectively. Standard ICS terminology (for functions, resources, facilities) and the utilization of standard procedures for communicating insures effective intra-agency communication and greater understanding and coordination among different agencies or departments that operate under an incident command system.

3.1.2 The common terms used in the FDNY ICS are contained in the Glossary of this document.

3.2 MANAGEABLE SPAN OF CONTROL

3.2.1 Safety and sound management practice dictates that a reasonable span of control exist. The organizational options within the FDNY-ICS are designed to provide span of control ratios that meet these requirements.

3.2.2 In general the span of control of any individual with management responsibility should range from three to seven with five being the ideal. Of course, there is allowance to vary this ratio under certain circumstances. For example, when units are in the process of "taking-up" from an incident "under control", there is less need for the close supervision required during the active firefighting period.

3.2.3 The kind of incident, nature of the tasks, safety factors and communications will affect the span of control consideration. If tasks are simple and routine, take place in a limited or small area, communications are good, no unusual safety hazards are present and the incident is reasonably stable, then one individual may supervise up to seven subordinates. Conversely, if tasks are demanding, take place over a large area, and the incident is escalating, the span of control might be reduced to three or four.

3.2.4 It is important to be proactive, anticipate change and prepare for it. This is especially true when an incident is escalating and good management is difficult because many people are reporting to the Incident Commander.

3.3 MODULAR ORGANIZATION

3.3.1 Modular organization means that the ICS organization evolves based on the type and complexity of the incident. A routine incident will have a simple structure. A complex incident will require a larger organizational structure. The structure may be expanded in anticipation of events that are predictable or those that have the potential for complex incident needs. The organization structure is reduced as the incident is brought under control and resources are released.

3.3.2 Incident Commanders are responsible for the performance of the five main functions within the ICS. The functions are COMMAND, PLANNING, OPERATIONS, LOGISTICS and FINANCE.

3.3.3 Following the span of control guidelines, an IC may respond initially with only a few units. If the IC can manage all the major functional areas no expansion of the organization is required. If, however, the incident continues to escalate, the IC may delegate one or more functions to other persons.

3.3.4 Each function or supervisory authority that is delegated performs a specific role in the system and is identified by specific ICS terminology.

3.3.5 **If any function is not delegated, it remains the responsibility of the Incident Commander.**

3.4 INTEGRATED COMMUNICATIONS

Communications in the System is managed through the use of a communications plan. Initial communications are on the tactical frequency. At major incidents, primary and secondary Tactical and Command channels are available. The Field Communications Unit or the Communications Coordinator will consult with the IC to satisfy the incident needs. Radios capable of communicating with other city, state and federal agencies are available.

3.5 UNIFIED COMMAND

3.5.1 Unified Command is a means of organizing different agencies who have statutory authority and responsibility at large scale incidents, into one coordinated and controlled effort. It is designed to minimize "turf battles" and promote close working relationships among different departments.

Under a "Unified Command" each department or agency will maintain control over its own personnel. It enables all involved agencies to perform their roles effectively, minimize inefficiency, and avoid duplication of effort.

3.5.2 The goal of this concept is to develop a single collective approach to managing an incident. The departments act as "one organization" and are managed as such. Instead of several command posts operating independently, the operation is directed from only one "Command Post".

3.5.3 Implementing the plan of action will be under the direction of an Operations Chief. The Operations Chief is normally from the agency which has the greatest involvement and responsibility at the incident.

3.5.4 Under a Unified Command, the Senior Officials from the agencies meet and work together at one location, developing a strategy and preparing a single plan of action that ensures an integrated operation that will maximize the use of all assigned resources. Communications flow and the ability to rapidly cope with changing incident conditions is improved.

3.5.5 For example, a plane crash will involve the Fire Department, Police Department, Federal Aviation Administration, National Transportation Safety Board, Port Authority and perhaps other agencies. All of these agencies will have different missions to perform in the same location and at the same time and will require a Unified Command Structure.

3.6 INCIDENT ACTION PLANNING

3.6.1 All incidents require a plan to solve problems. For routine incidents the initial IC (the first arriving officer) will do this according to established SOP. The plan of action (SOP) established is based on the known risks and hazards that are expected in the majority of our emergency response activities. Specific conditions requiring variations or adaptation of standard procedures are addressed by the first arriving officer and succeeding commanders.

3.6.2 At complex incidents with a large commitment of resources from multiple agencies, such as Hazardous Materials or mass casualty incidents, the SOP used in the early stage of the incident would be replaced by a written plan of action developed at the scene.

3.6.3 The plan is developed by a systematic process. The strategy and objectives are established by the IC. The tactical organization is directed by the Operations Chief. The tasks are performed by assigned resources. The planning process answers "What do we need to know?" and "What do we need to do?" at complex incidents.

3.7 DESIGNATED INCIDENT FACILITIES

3.7.1 An incident facility is an area that is established to serve a particular purpose. In the FDNY-ICS the facilities are given designated names. There are several types of facilities that can be established at an incident. Some are mandated by SOP.

3.7.2 The Incident Commander determines and designates the type(s) of facilities needed based on the incident.

The following are examples of facilities used in the FDNY-ICS:

A. Command Post - The Command Post (CP) is the area from which the IC performs the function of managing the incident. There should be only one " Command Post".

Initially, the CP will be staffed by the IC and his aide. If the incident escalates, individuals assigned to the Command Staff, Operations, Planning or Logistics will be present.

In multi-agency operations, the individuals designated by their respective agency should be located at the command post (Con-Edison, Department of Environmental Protection, U.S. Coast Guard etc.). It is from the CP that the IC delegates management functions to subordinate officers while he provides overall direction.

B. Staging - The area where resources are held awaiting assignment. A staging area may be located away from the incident or on the upper floor of a high rise building or any appropriate location based on need. Staging is under the direction of a staging officer who reports to the IC or Operations Chief when Operations has been staffed.

C. Recuperation and Care - The area where personnel are placed to rest, replenish fluids and be protected from the weather (heat or cold).

3.8 RESOURCE MANAGEMENT

3.8.1 Within the FDNY-ICS resources are organized in several ways, depending on the incident. Some resources are managed either as single units or teams. The ability to form single units into teams maximizes the use of resources, and reduces the communications load. Various options are available to the IC.

3.8.2 Knowledge of the current status of resources at an incident is critical to effective management. Up to date status of resources is accomplished by the resource and situation status unit. This function is initially performed by the aide of the first to arrive Battalion Chief. The status of resources is continually monitored and this keeps the IC informed and up to date.

3.8.3 All resources at the incident are assigned a status. In the FDNY-ICS resources are assigned to one of three status conditions:

A. Available - ready for immediate assignment.

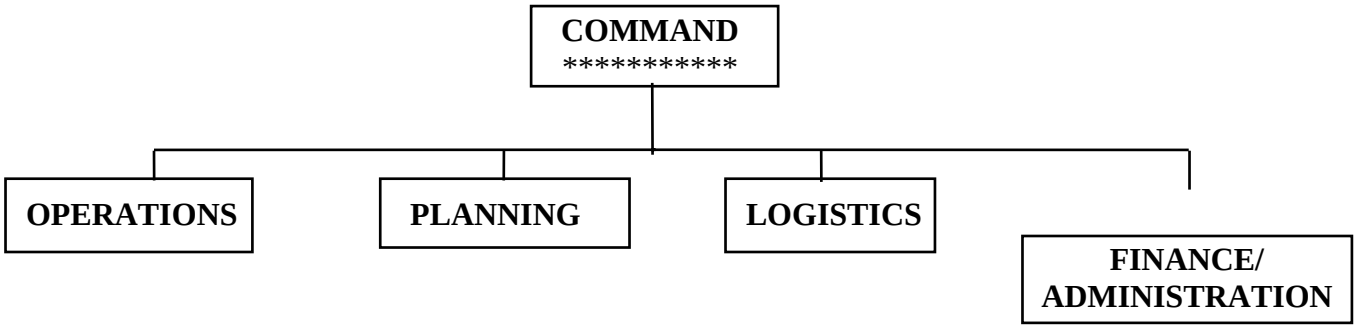
B. Assigned - performing an active assignment.

C. Out of Service/R&R - not ready for assignment.

3.8.4 **Changes in status or location of resources must be promptly reported by the individual who makes the change. This provides an accurate accounting of all tactical resources at the incident.**

4. DESCRIPTION OF THE INCIDENT COMMAND SYSTEM FUNCTIONS

4.1 **COMMAND** - is the functional authority the IC exercises over subordinates. It includes the responsibility for effectively using resources to accomplish strategy. It is the function through which all the incident activities (tactical and support) are directed, coordinated and controlled to accomplish the mission. It encompasses the personnel, equipment, communications, facilities and procedures to plan for what has to be done, issue orders and supervise the execution of operations.



4.1.1 At all incidents, COMMAND conducts a size-up, develops a strategy and is responsible for its outcome. Command staffs the functions necessary to support the incident.

4.1.2 The IC retains responsibility for Command and the performance of any functions or areas in the system that are not delegated.

4.1.3 At most incidents the IC will handle all the major functions within the ICS. As the incident becomes more complex or progresses to greater alarms, the IC must delegate some of the authority for performance of the functions to other individuals. Some ICS functions are automatically addressed in our SOPs.

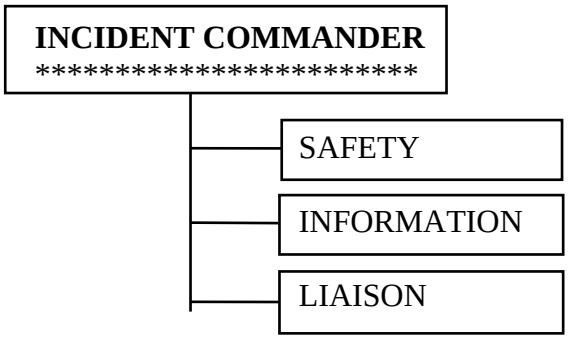
4.1.4 Delegation is the key to the FDNY-ICS. Each of the major functional sections concentrates on a primary assignment and is not distracted by other responsibilities. This provides functional clarity, greater attention to the details of a specific function and fixes accountability.

4.1.5 The IC has the option of implementing a **COMMAND STAFF**.
The Command Staff includes the following functions:

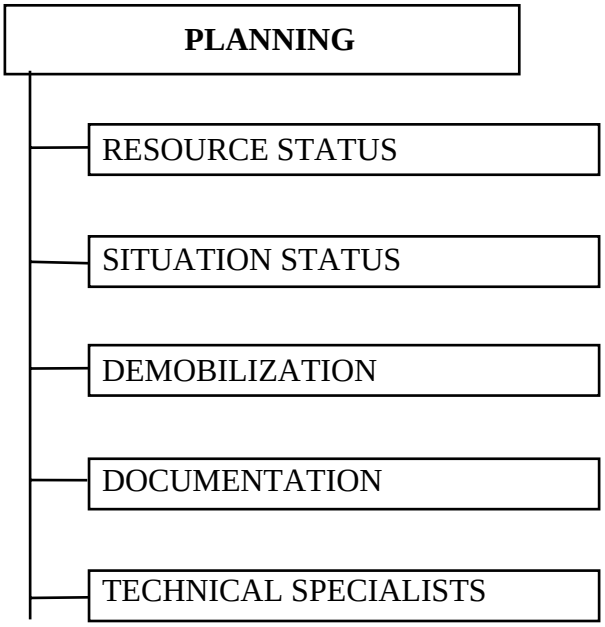
A. The Liaison Officer is the point of contact for assisting and cooperating agency representatives.

B. The Information Officer is responsible for gathering pertinent factual information concerning the incident. Upon approval from the IC, he will interface with the media and other agencies.

C. The Safety Officer is responsible for monitoring hazardous or unsafe conditions and initiating action to protect personnel from life-threatening situations.



4.2 **PLANNING** - is the function responsible for gathering, evaluating and disseminating information about the incident and status of resources. It prepares alternate strategies and objectives to control the incident. The Planning Section is comprised of several functions:



4.2.1 The Resource Status function is responsible for maintaining resource status information of all assigned resources at the incident.

4.2.2 The Situation Status function is responsible for the collection, processing and organization of incident information. Generally this information is graphically displayed on the command board.

4.2.3 The Demobilization function ensures safe, effective, organized release of resources from the incident.

4.2.4 The Documentation function maintains an accurate and complete log of incident records for analytical, historical and legal purposes.

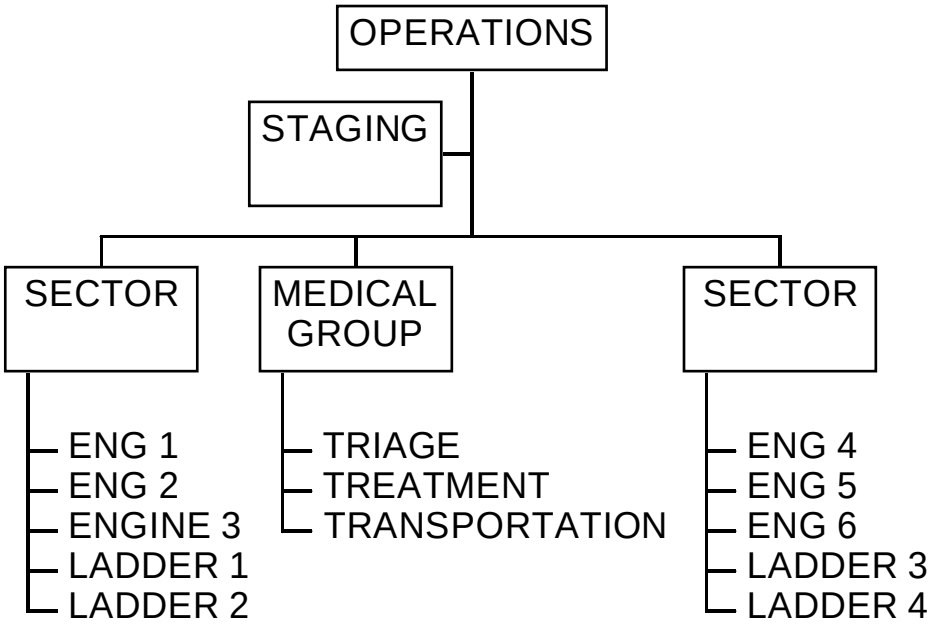
4.2.5 Technical specialists advise the IC on technical matters concerning incident operations such as environmental concerns, building construction, hazardous materials, specialized operations, etc.

4.3 **OPERATIONS** - is the function of managing all the tactical operations at the incident to accomplish the primary mission and plan of the Incident Commander.

All units are managed using the fundamental principles of Incident Command. An Officer assigns and supervises various functions (such as pump operator, forcible entry etc.) at each operation. These functions form the basis of our standard operating procedures. The Company organization provides for a manageable span of control over specific functional areas.

As operations escalate beyond the first responder SOP, succeeding commanders have several options available. Unless mandated, the specific command options utilized at an operation (within the ICS parameters) depend on the nature and complexity of the incident and the needs of the Incident Commander. ICS is not rigid. Experience, common sense, and imagination are the guiding principle in using these options.

These options may be activated at any appropriate level of command to solve/reduce span of control problems. They provide control, supervision and coordination in a designated area or for a specific function. They fix personnel accountability.



4.3.1 The following describe the options available within the System to utilize resources:

A. SINGLE RESOURCES

Company - A company is a vehicle providing equipment capability and personnel such as an Engine Company, Ladder Company, Rescue Company.

Team - A specific number of personnel assembled for an assignment such as search, ventilation under the direction of a team leader.

B. COMBINING RESOURCES

To maintain a manageable span of control, reduce communication, improve control and coordination, single resources may be combined into sectors and groups.

1. **Sector** - Defines the activities and operations of resources within an assigned geographical area. For example, the IC might form a sector from units operating in an exposure to reduce the span of control and more efficiently manage radio traffic by only dealing with one sector supervisor. A sector is managed by a sector supervisor.

2. **Group** - Consists of resources formed to address specific functional tasks. For example, the IC forms a group to search specific floors of a high rise building. Each resource within the group performs the search function and reports to a group supervisor. Additionally, at the scene of a multiple casualty incident resources may be assigned to perform the functions of triage treatment and transportation. The IC has achieved closer supervision of the units and a reduced number of radio contacts. This allows more time to deal with other problems that exist. A group is managed by a group supervisor.

   a. Functional and geographical assignments may not always require the implementation of a group or sector. An activity that requires one unit to effectively handle the problem would not need the activation of a sector or group. There would not be a coordination problem and the assignment does not cover a large area or the supervision of many units.

   b. While sectors are restricted to a specific geographical area such as an exposure, groups may cross sector boundaries to accomplish an assigned functional task e.g., search. When a group is assigned a task or function that overlaps sector boundaries, the sector may be relieved of that responsibility. Groups and sectors coordinate their efforts and report to the next higher level of command.

c. Sector/group supervisors are responsible for the implementation of their assigned portion of the tactical plan and they coordinate activities within their assignment. They assign specific tasks to units or teams under their control.

d. Sector/group supervisors keep the next higher level of command informed of the status of conditions and resources within their assigned area of responsibility.

e. Sector/group supervisors require certain information from the next higher level of command. They must know their radio designation, assigned objectives, and resources assigned to their command.

C. SPECIAL APPLICATION

1. **Strike Team** - Specific combinations of the same kind and type of resources, with common communications under the supervision of an officer (e.g. five engine companies and a Chief Officer dispatched to other jurisdiction, Suffolk/Nassau County, New Jersey).

2. **Task Force -** Any combination of resources with communications capability under the supervision of an Officer, put together for a temporary assignment. The number of resources in a task force should be limited to five for control purposes. A task force may be formed when more than one unit must be managed. Task forces may be formed for many functions. They may be pre-established or made up at the incident (members of FDNY-FEMA Urban Search and Rescue Task Force).

4.3.2 BRANCHES - EXPANDING THE ORGANIZATION

The next higher form of organizational tool available to the IC is called a BRANCH. A branch is created when the span of control over sectors and groups is excessive or at major incidents when resources from other agencies are committed. A branch is managed by a Branch Commander.

Branch Commander:

1. Manages a specific part of the tactical plan appropriate to that branch.
2. Coordinates the activities of units within the branch.
3. Assigns specific tasks to sectors or groups within the branch.
4. Keeps the next higher level informed of the status in the area of responsibility.

Branches may be established at an incident to serve several purposes. In general, branches may be established for the following reasons:

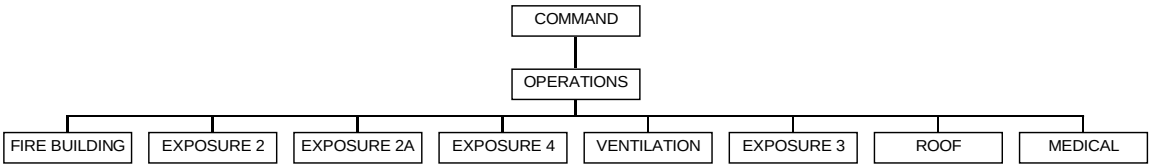
- Span of control
- Functional
- Multi-agency

A. SPAN OF CONTROL

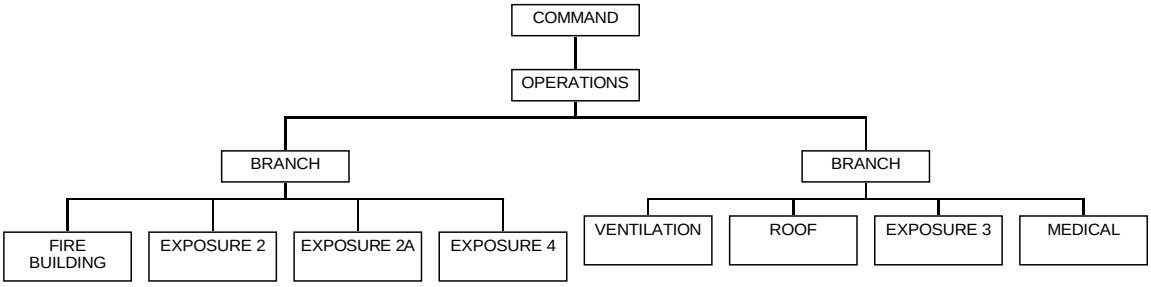
Branches should be utilized at incidents where the span of control of sectors or groups becomes unmanageable.

In the following example, if the organization were formed this way the operations chief would be beyond a manageable span of control.

Before Multi-Branch Structure



A two-branch organization would be appropriate.

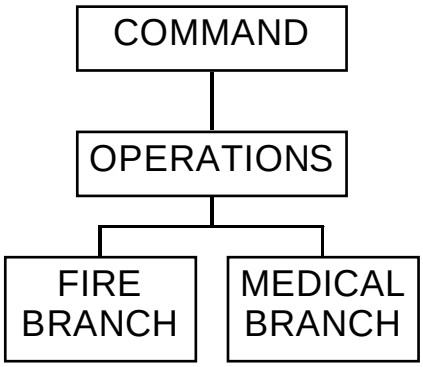


Branches should operate in their area of responsibility. The radio designation should reflect the objective of the branch. When Operations implements a branch, the sector should be notified of their new supervisor.

B. FUNCTIONAL BRANCHES

When the nature of the incident calls for a functional branch structure, the organization is created with each functional branch under the direction of a single operations chief.

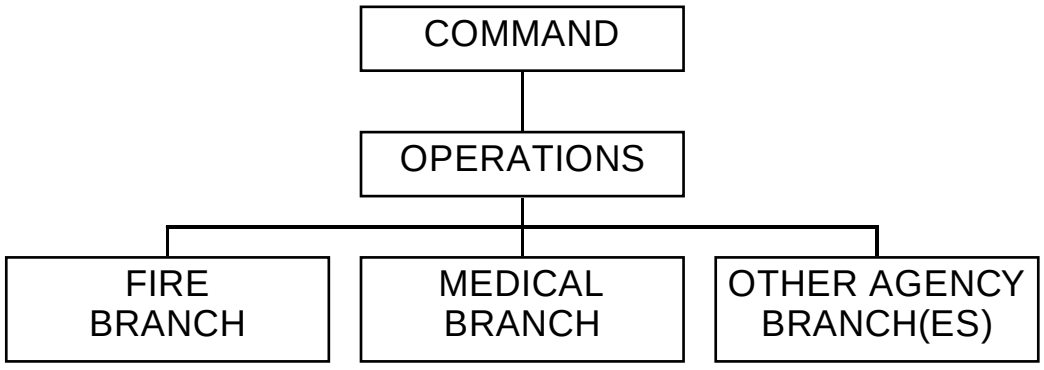
In the following example a medical function was added because the complexity of the operation was beyond the sector or group level's capability.



C. LARGE SCALE MULTI-AGENCY INCIDENTS

When the incident requires a large commitment of resources from multiple agencies, resources are best managed by the agency which has normal control over those resources. It is anticipated other agencies would operate as their branch under the direction of a single operations chief.

An example would be a major hazardous materials incident requiring multi-agency commitment.



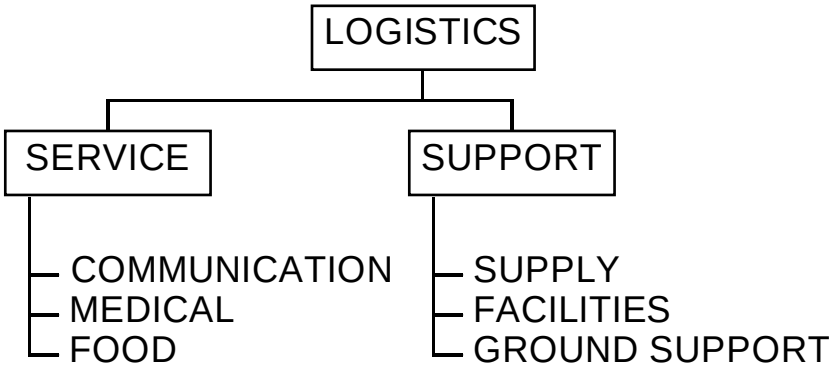
4.3.3 STAGING - A specific area to which resources are assigned before deployment. Staging has several advantages:

1. It gives the IC breathing room to make better decisions about deployment.
2. It is a checkpoint to provide accountability and prevent freelancing.
3. It provides an area of protection from exposure in hazardous environments.
4. It establishes a reserve immediately available for a contingency.

Initially, the staging area can be managed by the IC. If an incident is very complex, the IC can set up a formal staging area and assign an Officer as Staging Area Manager.

If the position of Operations is staffed, Staging reports to Operations since this Chief now is managing the tactical part of the incident action plan. The Operations Section allocates the available resources from a defined staging area.

4.4 **LOGISTICS** - is the function which provides the supplies, services and facilities needed support the incident. Within the Logistics Section, functions are carried out through various Service and Support functions.



4.4.1 Service branch includes Communication, Medical, and Food Units.

A. Communications establishes and operates the network of resources to manage the radio traffic and information flow within the ICS and between the Command Post and the dispatcher.

B. Medical - responsible for ensuring medical aid and transportation for injured and ill incident responders. This unit does not provide treatment for civilians.

B. Food - responsible for coordinating the feeding of personnel at extended operations, if necessary.

4.4.2 Support branch includes the Supply, Facilities and Ground Support Units. It's function is to supply and re-supply the hardware and special equipment to carry out and sustain the operation.

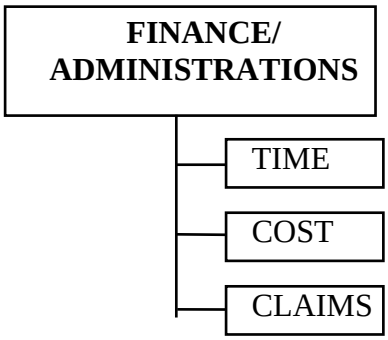
A. Supply - responsible for providing, ordering equipment and receiving supplies for the incident.

B. Facilities - responsible for layout and activation of incident facilities e.g., Command Post, and Rehab.

B. Ground Support - is responsible for support of out-of-service resources, fueling, service, and repair of vehicles, as well as transportation.

C. Special units - responsible for providing any equipment and supplies for the incident.

4.5 **FINANCE/ADMINISTRATION** - is the function responsible for financial cost recording and recovery when possible for the incident operations.



4.5.1 The Finance Section is responsible for recording vendor contracts and collecting expenses and cost data for the incident. It provides cost estimates and cost-saving recommendations.

4.5.2 Under most circumstances, this function is performed as part of the Department's normal administrative function. However, cost recovery and budget justification begin with data collection and tracking. Commanders at every level should be aware of the actual and potential impact of the costs of emergency operations in decision making.

5. SUMMARY

5.1 Think of the FDNY-ICS as a toolbox, available to help the IC manage the incident. Use only the tools that are needed. The use of the tools that are available to you will make the job of managing an incident more tolerable and less stressful. Tools that are not needed should be left in the box.

5.2 Incident Command is not a static concept. The System and this document are meant to be used and constantly improved to meet the changing and challenging environment facing emergency services. Other training materials, checklists, guides and support materials and SOP's are under development to support professional operations in the field.

5.3 Practice and experience using the Incident Command System and its components will determine the level of professionalism, safety and efficiency achieved in emergency operations by this Department.

- END OF PART 1 -

ICS POSITION GUIDES

Appendix A
Incident Command System
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1. INTRODUCTION

This part of the ICS manual will deal with the factors which must be considered when the various positions of the ICS are to be established.

2. LOGISTICS

2.1 ESTABLISHMENT OF RECUPERATION AND CARE (RAC) AREA
Any incident that is large in size, long in duration, and/or labor intensive will rapidly deplete the energy and strength of personnel and therefore merits consideration for rehabilitation. Severe climactic or environmental conditions will also necessitate the establishment of a Rehabilitation area. The following factors must be considered

A. Location:
The Incident Commander shall designate the location of the RAC Area. When a RAC Area is established, it may be necessary for the Incident Commander to designate a RAC Officer. Large scale operations may require the assignment of a Chief Officer to fill this position. (See AUC 230 Section 2.3, 3.1 and 3.2for the duties of the Rac Officer/Chief).

B. Site Characteristics:
1. A location that can accommodate the placement of RAC Units. (See AUC 230, Sections 1 and 2 for the description, response, and duties of RAC units).
2. A location that offers protection from environmental conditions.
3. Free of exhaust fumes, apparatus, and equipment.
4. Large enough to accommodate several units, and allow members to remove their Bunker Gear.
5. Easily accessible to E.M.S.

C. Hydration:
Members in the RAC Area should maintain a high level of hydration. During heat stress, members should consume at least one quart of water per hour.

D. RAC:
Units/members shall be considered for RAC based not only on energy expended at a fire/emergency, but also on the previous activity of the units/members prior to operating at a fire/emergency. Rest periods of two hours can be given by Battalion Chiefs, and three hours can be given by deputy Chiefs.

Note: Members should not be moved from a hot environment directly into an air conditioned area because the body's cooling system can shut down in response to

the external cooling. an air conditioned environment is acceptable only after a "Cool Down" period at ambient temperature with sufficient air movement.

- END OF PART 4 -

EMERGENCY RESPONSE PLAN: HAZARDOUS MATERIALS

Appendix A
Incident Command System
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1. INTRODUCTION AND STATEMENT OF COMMAND CONCEPTS

1.1 PLANNING BASIS

In order to carry out the responsibilities delineated in the New York City Hazardous Materials Response Plan (Mayoral Directive 82-2 Revised) and to comply with standards established by federal legislation the FDNY Emergency Response Plan for Hazardous Materials is established. This plan will guide and direct the action of all responding Fire Department personnel at hazardous materials operations.

In the event of a significant accident or other incident involving a toxic or hazardous material where, because of fire, explosion, radioactivity, toxic air release or chemical reaction there exists danger to the health or safety of emergency personnel or to the general public, the senior Fire Department representative, referred to as the Incident Commander (IC), at the scene will implement the FDNY Emergency Response Plan (ERP) for Hazardous Materials.

1.2 AGENCY COORDINATION

This plan is built on the fundamental organization and strategy of the FDNY Incident Command System (ICS) insuring maximum safety and efficiency of the operating forces while fulfilling our responsibility to the public.

It is assumed that all hazardous materials incidents will be managed under Unified Command principles because in virtually all cases fire, police, and public health agencies will have some statutory functional responsibility for incident mitigation.

Implementing the ERP will facilitate the coordination and control of all tasks and functions with the senior on-site representative of the Police Department who has been designated as the "On Scene Coordinator". Using the ERP and working closely with the On-scene coordinator, the Incident Commander will manage the command and control of all mitigation tasks and functions. When the Interagency Command Center (ICC) is established the IC will represent the Fire Department at the Command Center.

All mitigation operations at the incident will be managed by the Fire Department. Tactical operations will be managed by the Fire Department Operations Chief.

Specific tactical objectives will be carried out by Group/Sector Supervisors. Other needs will be met by staffing ICS positions.

2. ORGANIZATIONAL DEVELOPMENT

2.1 RESPONSE OBJECTIVES AND STRATEGY

Any hazardous materials incident represents a potentially dangerous situation. Chemicals that are combustible, explosive, corrosive, toxic, or reactive, along with biological and radioactive materials can affect the general public or the environment as well as the emergency responder. Emergency responders may be subject to additional dangers operating in this abnormal environment. While the response activities needed at each incident are unique, there are similarities. One is that every response requires protecting the health and ensuring the safety of the responders.

This document identifies the functions needed to control and mitigate a hazardous materials incident. It also describes the lines of authority, responsibility, and communication between and among the various responders. It defines the interface of the Fire Department with other agencies. Finally, it specifies the authority of each responder in directing specific operations.

This plan will provide instructions on how to accomplish specific tasks in a safe manner. In concept and principle, standard operating safety procedures are independent of the type of incident. Their applicability at a particular incident must be determined and necessary modifications made to match prevailing conditions. However, in the case of hazardous materials operations, the specific requirements of training, equipment, and competence preclude the generalized statements that might apply to other types of emergency work.

The ERP will provide guidance for Fire Department responders in areas related to response, site control, entry, and mitigation of hazardous materials incidents.

This guide is not meant to be a comprehensive treatment of each of the subjects discussed. Formal training in these areas will complement this document. Specific training will provide more information for the technical, administrative, and management oriented skills needed to fulfill our mission. This document will provide standard operating guides to develop more specific procedures.

The priority of the instructions in this plan is as follows:

A. Life safety and health risks to the public and the emergency responders are the most important concern.

B. The Fire Department must stabilize the incident scene and prevent further escalation of the incident with minimum personal risk.

C. The Fire Department's response efforts should be directed toward protecting property and minimizing or lessening the impact of the event on the environment.

2.2 INCIDENT CHARACTERIZATION

In the same way that units now call for additional assistance at a fire, hazardous materials incidents require that a method be established to determine the degree of severity for various types of releases. This avoids the need for calling out full resources for every incident. Personnel arriving at an incident can, of course, request additional resources and thereby raise the level of response based on the actual circumstances of the event. Response planning, procedures, and notifications to Federal, State, and City agencies will be determined by the following standard designations.

2.2.1 LEVEL 1: An incident which can be controlled by the responding unit or units up to 3 Engines, 2 Ladders and 2 Battalion Chiefs and does not require evacuation of other than the involved structure or the immediate outdoor area. The incident is confined to a small area and does not pose an immediate threat to life or property.

A Level 1 incident includes the units on the scene up to and including the full first alarm assignment. It is not a request for additional units or specialized resources. It signifies the degree of hazard and the ability of the units on the scene to safely manage the incident. Additional resources or greater alarms may be transmitted at the discretion of the Incident Commander. This may indicate a need to upgrade the incident to Level 2.

2.2.2 LEVEL 2: An incident involving a greater hazard or a larger area which poses a potential threat to life or property and which may require a limited evacuation of the surrounding area.

A Level 2 incident requires the response of a Deputy Chief, Hazardous Materials Unit, Safety Operating Battalion, Field Communications Unit(DO 154/93) and SOC and a total first alarm assignment of 3 Engines, 2 Ladders and 2 Battalion Chiefs.

2.2.3 LEVEL 3: An incident involving a severe hazard or a large area which poses an extreme threat to life and property and will probably require a large scale evacuation; or an incident requiring the expertise or resources of City, State, Federal, or private agencies and organizations.

A Level 3 incident requires activation of the full NYC Emergency Response Plan. Additional alarms or other Fire Department resources may be called by the Fire Department Incident Commander.

2.2.4 The following table is presented for guidance in determining these levels. The highest level for any single condition will determine the incident level. For example, poison gas (such as cyanide or phosgene) could initially require a Level three response due to the nature of the danger to the public. An incident level and the response can always be downgraded when additional information or resources become available. However, it is much more difficult to upgrade and obtain control when situations are going beyond the capabilities of the on scene resources.

CONDITION	LEVEL ONE	LEVEL TWO	LEVEL THREE
PRODUCT	NO DOT PLACARD REQUIRED ORM A,B,C,D	DOT PLACARD PCBs/NO FIRE EPA REGULATED WASTE** ANY UNIDENTIFIED SUBSTANCE	POISON A, EXPLOSIVE A/B, ORG. PEROXIDE, FL. SOLIDS(WR), CHLORINE, FLUORINE, ANHYDROUS AMMONIA, RADIOACTIVES, PCBs on FIRE
NFPA #704	0 OR 1 ALL CATEGORIES	2 FOR ANY CATEGORY	3 OR 4 ANY CATEGORY INCL. SPECIAL HAZARDS
CONTAINER SIZE*	SMALL	MEDIUM	LARGE
CONTAINER INTEGRITY	NOT DAMAGED	DAMAGED BUT SERVICEABLE FOR HANDLING OR TRANSFER OF PRODUCT	DAMAGED, CATASTROPHIC RUPTURE POSSIBLE
LEAK SEVERITY	NO OR SMALL RELEASE CONTAINED OR CONFINED W/ AVAILABLE RESOURCES	NOT CONTROLLABLE W/O SPECIAL RESOURCES or "REPORTABLE QUANTITIES"	MAY NOT BE CONTROLLABLE EVEN WITH SPECIAL RESOURCES
FIRE / EXPLOSION POTENTIAL	LOW	MEDIUM	HIGH
LIFE SAFETY	NO LIFE HAZARD	LOCAL AREA, LIMITED EVACUATION	LARGE AREA, MASS EVACUATION
IMPACT ON ENVIRONMENT	MINIMAL	MODERATE	SEVERE

*****small = Pail, drum, cylinder, package, bag.
medium = One ton containers, portable containers, nurse tanks, multiple packages.
large = Tank cars/trucks, stationary tanks, hopper cars/trucks, multiple medium containers
****** e.g. asbestos

2.3 EMERGENCY ALERTING AND RESPONSE

Initial notification of a hazardous materials incident will be through transmission of the radio signal 10-80. Transmission of the signal 10-80 will serve to warn responders to proceed with caution to avoid entering a restricted area.

As soon as possible, the Officer assuming Command will briefly describe the nature of the incident, identify a preliminary hazard perimeter and transmit this information to the dispatcher for the benefit of other responding units and agencies that will be notified. If possible, a preliminary Staging area should be designated. The intent is to limit unnecessary exposure of personnel and equipment. More specific information should be relayed to the dispatcher in progress reports as it becomes available.

The following notifications of a hazardous materials incident will be made by the Dispatcher upon receipt of all 10-80 code 2 signals (Level 2 or 3 incidents) and when the Hazardous Materials Unit responds.

A. Police Dept. Operations Unit
B. Dept. Of Environmental Protection
C. NYC Emergency Medical Services
D. NYC Dept. Of Health - for incidents involving radioactive materials.
E. NYS Dept. Of Environmental Conservation - for fuel oil spills.

2.3.1 On transmission of a 10-80 code 2 signal (Level 2 or 3 incident), the dispatcher will order the response of a Deputy Chief, Hazardous Materials Unit, Safety Operating Battalion, Field Communications Unit(DO 154/93) and Special Operation Command and a total first alarm assignment of 3 Engines, 2 Ladders AND 2 Battalion Chiefs.

The following Fire Department units will also be notified:

1. Fire Command or the City Wide Command Chief during non-operating hours of the Fire Command.
2. Notifications Desk, Bureau of Operations.
3. Public Information Office
4. Medical Officer on Duty

As is the case in other fire and emergency operations, the Incident Commander may call for additional units and activate and staff any part of the ICS appropriate to the apparent circumstances.

2.4 RESPONSE ORGANIZATION

Under the Incident Command System, the incident organization will develop in a modular progression depending on the exact nature and specific conditions prevailing at the scene.

2.4.1 The first response of the Fire Department will be managed by the senior ranking officer on the initial alarm who will be the Incident Commander. This could be the Lieutenant or Captain of the first company to arrive. Responsibility for command will be transferred to succeeding commanders using the established lines of authority within the Incident Command structure.

The Incident Commander on the first alarm will implement the ERP for hazardous materials and assume responsibility for all command and command staff functions necessary to manage the initial response. The IC will call additional resources as incident needs dictate.

First responders at this level have been trained to implement offensive and defensive control measures for common hazardous materials involving limited quantities of certain materials as specified in standard operating procedures. (See 10.3 - Hazard Action Guides) They will be capable of performing the following basic procedures:

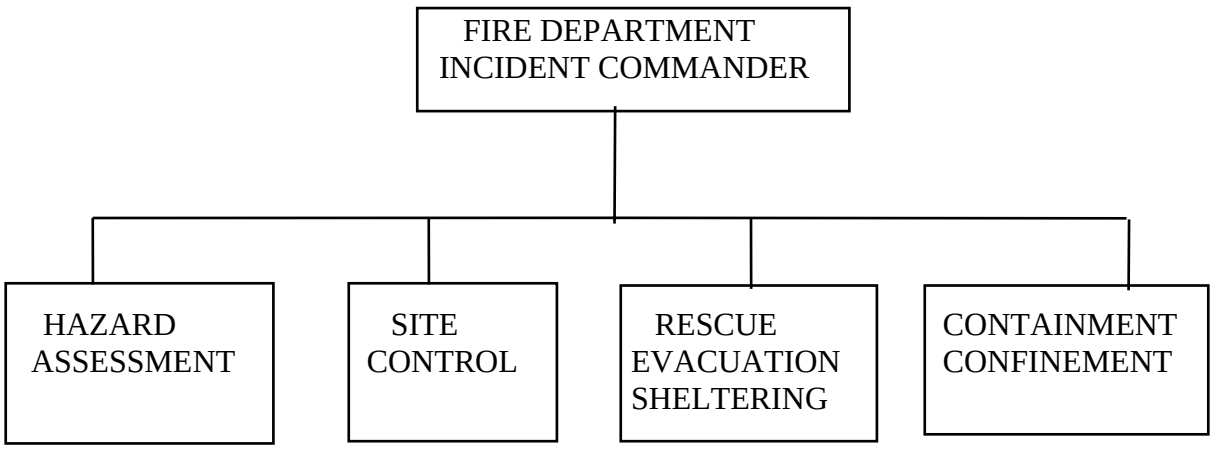
A. Initiate the Emergency Response Plan including isolating the site, establishing an initial Command Post, and establishing a site safety plan.

B. Notify the Dispatcher of the need for additional resources. Communicate essential information about the incident to other responders through the Dispatcher.

C. Initiate evacuation, if appropriate.

D. Initiate basic hazard and risk assessment activities including the use of personal protective equipment; preliminary identification of materials; containment and confinement of the material within the limits of the resource and protective equipment capabilities available on site.

E. Understand and comply with "decon" procedures.



2.4.2 If an incident is beyond the capability of the first responders, the ICS will be expanded to include the Hazardous Materials Group and other responders with a higher level of training and more specialized skills and equipment.

As the incident progresses it may be necessary to modify/expand the organization structure so tasks may be accomplished as efficiently and safely as possible. Changes will be recorded in the Incident Log and the Command/Control Chart with affected positions notified.

Responders at this next level will be operating in a more complex environment that requires the coordination of several different agencies.

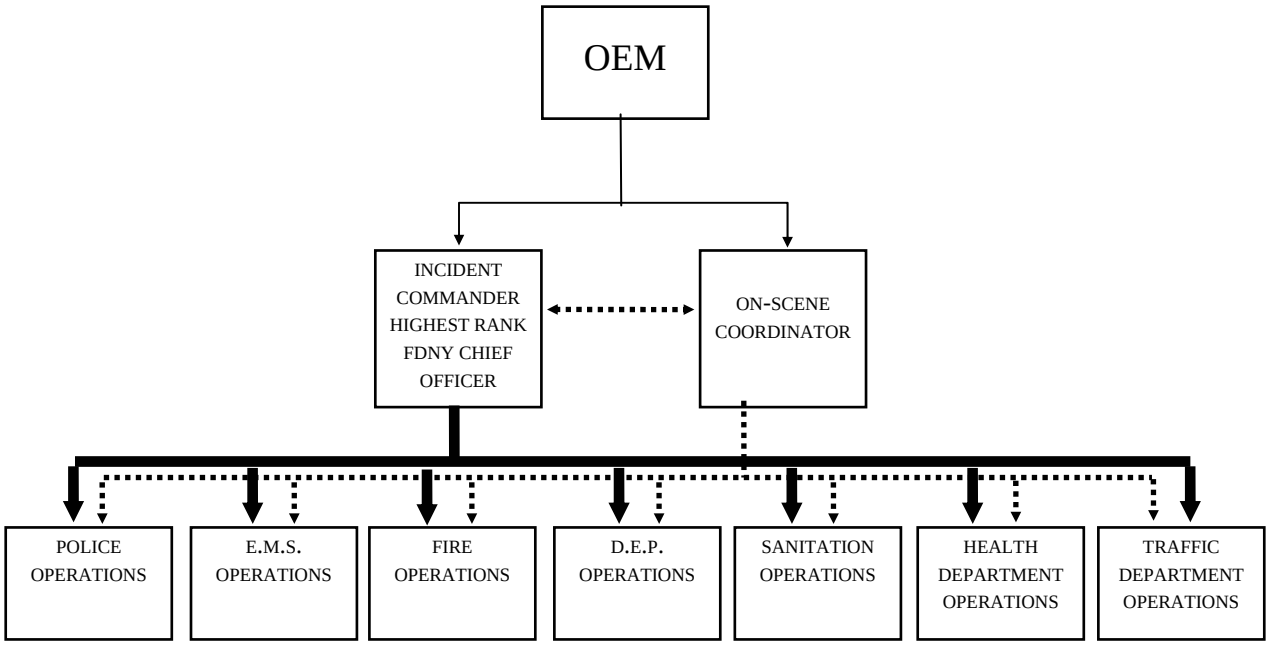
2.4.3 A more complex operation requires a unified command structure composed of the senior officials of various agencies. They will determine strategies and objectives that will fulfill their individual responsibilities while coordinating the actions of their respective personnel through the On-scene Coordinator.

Tactical activities for the Fire Department will be managed by the Operations Chief.

The Fire Department Hazardous Materials Group will manage all activities in the contamination zones. Only specially trained and equipped personnel will enter the contaminated zones.

Fire Department personnel in the contaminated zones will be operating in a more aggressive manner than the first responders in that they will actually approach a hazardous material, its container and associated devices in attempting to control, contain, confine, or prevent a release.

EXAMPLE OF INCIDENT ORGANIZATION: LEVEL 2 or 3 INCIDENTS



▬▬ = Activities and Operations directly relating to the mitigation of the problem.

····· = Activities and Operations directly relating to the Coordination and Overall Management of the Incident.

3. GENERAL INCIDENT PROCEDURES AND SITE SAFETY

HAZARD ASSESSMENT

Early recognition of incident hazards and potential risk is essential. The initial responsibility for assessment of incident hazards lies with first responding units.

Responding units will gather and communicate to the Incident Commander pertinent information regarding the presence or release of hazardous materials or chemicals.

Each member should be alert to the signs, evidence, and indications of the presence of hazardous substances during fires and emergencies and report such information to the next higher level of command.

3.1.1 Persons reporting emergencies will usually describe the kind of incident creating a hazardous condition. They generally are unable to accurately describe a hazardous materials incident.

Since accurate information about the incident or site might not be available when responding, special attention should be focused on the possibility of exposure in the following circumstances:

A. Transportation accidents
B. Industrial accidents
C. Leaks, spills, or suspicious odors
D. Medical emergencies involving chemical inhalation
E. Explosions
F. Structural collapses

3.1.2 Information regarding hazardous occupancies or locations that has been obtained through inspection or preplanning activities should be available from "CIDS Information", described in the Communications Manual. This type of response information prior to arrival will prevent premature entry into dangerous environments and unnecessary exposure to responding personnel. It will also offer a significant measure of protection to responders unfamiliar with the location or occupancy.

3.1.3 On - site information gathering must be limited to that which can be obtained within the limits of each responders level of training and protective equipment. It is not in the best interest of the public or the responders to become part of the emergency problem instead of the solution.

First responders should gather, evaluate, and report information prior to entering into or undertaking activities that would place them in a contaminated environment.

3.1.4 The following are environments that must be evaluated before any commitment of personnel for any reason:

A. Large containers or tanks that must be entered.
B. Confined spaces (manholes, trenches, etc.) that must be entered.
C. Potentially explosive or flammable situations indicated by gas generation or gas release or over pressurization of containers (BLEVE).
D. Presence of extremely hazardous materials such as cyanide, phosgene, or radioactive materials.
E. Visible vapor clouds.
F. Areas where biological indicators such as "Unconscious persons" (refer to Section 3.6), dead animals or vegetation are located.

3.2 SITE SECURITY AND CONTROL

An incident generally involves the escape of normally controlled substances and response activities involve actions to minimize and prevent these discharges. Site Control is preventing or reducing the exposure of any person and the transfer of hazardous substances (contaminants) from the site by civilians, department members and equipment. Site control involves two major activities:

A. Physical arrangements and control of the site work areas.

B. The removal of contaminants from people and equipment.

Control is needed to reduce the possibility of transport from the site of contaminants, which may be present on personnel and equipment. This can be accomplished in a number of ways including:

A. Establishing physical barriers to exclude the public and unnecessary personnel.

B. Establishing checkpoints with limited access to and from the site, or areas within the site.

C. Minimizing personnel and equipment on-site consistent with effective operations.

D. Establishing containment zones.

E. Undertaking decontamination procedures.

F. Conducting operations in a manner to reduce possibility of contamination.

3.3 DECONTAMINATION

Decontamination (DECON) is the process of making personnel, equipment and supplies safe by reducing present levels of poisonous or otherwise harmful substances. This process is one of the most important steps in ensuring personal safety at a hazardous materials emergency. The extent of its success depends on the ability of the IC to maintain control of personnel at the site.

The detail of decontamination operations required at an incident depends on the safety and health hazards of the contaminants. An uncontaminated light oil, for example, that presents a minimal hazard can be partially decontaminated by flushing it from protective clothing. In contrast, a poisonous material will require a careful and detailed course of action.

See "SAFE WORK PRACTICES - Decontamination Procedures", Section 5.3 of this document for more detailed information.

3.4 EMERGENCY MEDICAL TREATMENT

Teams from the Emergency Medical Service (EMS) are available to assist in medical treatment, and monitor the response personnel and others exposed to hazardous materials.

The Fire Department Medical Officer on duty will also be notified of all Level 2 or greater incidents and will respond in accordance with Dept. policy.

3.5 PERSONAL PROTECTIVE EQUIPMENT (PPE)

3.5.1 **Structural firefighting gear** is designed to protect firefighters from heat and flame.

Hazardous materials can contaminate protective clothing, respiratory equipment, tools, vehicles, and other equipment used at an emergency scene.

First responders should avoid leaks, spills, and obvious sources of hazards, as well as indirect contact with potentially contaminated areas. Full firefighting gear and SCBA will be used at all times as a minimum of protection against exposure. Safe work practices WILL MINIMIZE exposure and contamination.

3.5.2 The use of Chemical protective clothing and equipment requires specific skills acquired through training. It is only available to members of the Hazardous Materials Unit.

This type of special clothing may only protect against one chemical, yet be readily penetrated by other chemicals for which it was not designed. It offers little or no thermal protection in case of fire. No one suit offers protection from all hazardous materials.

3.5.3 The level of special protection required in each zone at an incident will be determined by the Officer in charge of the Hazardous Materials Unit based on information available.

3.5.4 The levels of protection available include:

A. **"Level A"** highest level of protection to the responder.

B. **"Level B"** high level of protection to the respiratory tract but a lower level of skin protection than level "A".

Level "A and B" protective equipment is only available for use by members of the Hazardous Materials Unit.

C. **"Level C"** does not require maximum skin or respiratory protection. This level presupposes that the types of air contaminants have been identified, concentrations measured, and the atmosphere is not oxygen deficient.

D. **"Level D"** provides minimal protection and is used to guard against nuisance contamination only.

Structural firefighter protective clothing, i.e. turnout or bunker gear, is not classified as chemical protective clothing. The highest level of chemical protection that this level will provide is Level "D".

3.6 RESCUE

In most situations emergency personnel can protect the public by isolating and denying entry to contaminated areas. Initial rescue actions should concentrate on removing able-bodied persons from immediate danger. Involvement in complicated rescue problems or situations should be evaluated before being attempted.

When the probability is high that the victim cannot be saved or is already dead, rescue should not be attempted if it will place the rescuer at unnecessary risk. The danger of exposure to unknown chemicals or a potential explosion may make the risk unacceptable.

The following should be considered in attempting a rescue during a hazardous materials emergency:

A. Has the presence of a victim been confirmed visually or by other credible sources?

B. Is the person conscious or responsive?

C. How long has the victim been trapped or exposed? Is he/she viable?

D. Is the leaking material pooling or vaporizing in the area of the victim?

E. What are the properties of the material involved? What is the concentration of the material around the victim?

F. What special equipment is available to assist in this effort?

Consideration of these questions will help in weighing the likelihood of a successful rescue against the overall risk to the rescuer.

3.7 EVACUATION / SHELTERING

There are essentially two ways to protect the public from the effects of hazardous material discharges into the environment.

A. Evacuation: involves moving threatened persons to shelter in another area.

B. Sheltering in place: involves giving instructions to people to remain where they are until the danger passes.

Evacuation is clearly safer with respect to the hazards, but has certain limitations and may pose new problems. Evacuation takes time and may not be possible if large numbers of persons or a large volume of vapor is present. Evacuation through a toxic atmosphere may actually cause more harm than good in some cases.

3.7.1 Evacuation is best considered when:

A. There is an immediate danger of fire or explosion.

B. The potential for a discharge is great, it has not taken place, and there is time available to relocate people.

C. The discharge has taken place but people are sufficiently protected to permit time for evacuation.

D. People not yet in the path of a release will be threatened by changing conditions.

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3.7.2 Large scale evacuation will be directed by the On Scene Coordinator and will require the coordinated efforts of several agencies.

3.7.3 The decision to shelter in place is appropriate when the hazardous material will not affect the structure or its occupants or the hazard will pass a structure with little infiltration.

3.7.4 Sheltering in place is the alternative when:

A. Pre-planning has identified options for problem areas such as hospitals, jails, nursing homes, public assemblies, etc.

B. Evacuation cannot be properly managed with the manpower, resources, and facilities presently available.

C. The hazardous material displays the following characteristics:

1. Low to moderate toxicity;
2. Totally released and dissipating;
3. Small quantity solid or liquid leak;
4. A migrating vapor of low toxicity and quantity and people are safer indoors than outside; and
5. Release can be rapidly controlled at the source.

3.7.5 The success of either option will depend on the preplans and effectiveness of communication resources, notification and public information.

3.8 EMERGENCY EQUIPMENT

Private corporations, outside agencies, and other city agencies maintain specialized equipment and services that may be placed at the disposal of the Fire Department for use at these incidents. A catalogue of these services and equipment is maintained by the Bureau of Fire Communications. Calls for the use of these services or cooperation of these agencies shall be transmitted to the Dispatcher by the IC. Approval will come from the Commissioner and Chief of Department or their designee.

Liability, costs to the provider, and the availability of certain types of equipment preclude irregular or other informal arrangements.

The IC will designate the exact location to which the special equipment will respond.

4. ROLES AND RESPONSIBILITIES OF FIRE DEPARTMENT RESPONDERS

4.1 **INCIDENT COMMANDER - Responsible for all Fire Department incident activities, planning and checklist functions, preparation of reports, incident termination, and post incident analysis.**

The senior ranking Officer first on the scene will determine the need for the following actions and implement those that are necessary and within the capability of the resources and equipment available at the time.

Succeeding Commanders will further evaluate the needs of the incident and refine, reinforce, or expand the scope and depth of these response activities.

A. COMMAND

1. ESTABLISH A SITE SAFETY PLAN

a. Set up isolation, control, and support zones. Refer to site plans, if available.
b. Limit and control site access.
c. Set up and manage staging areas.
d. Coordinate F.D. personnel, on site personnel and other support agency activities.
e. Call for resources/support units.

2. ESTABLISH LINES OF COMMUNICATION

a. Announce location of Command Post, Staging areas.
b. Report incident and site information to Dispatcher.
c. Communicate plan of action to on scene personnel.
d. Establish contact/communications with other agencies responding.
e. Consult on site personnel/specialists.

3. ESTABLISH A COMMAND POST

a. Establish F.D. Command Post.
b. Set up/maintain Command & Control Chart.
c. Establish and maintain incident log.

4. STAFF ICS FUNCTIONAL POSITIONS (as needed)

a. Safety, Liaison/Information.
b. Staging.
c. Operations, Planning, Logistics, Finance.
d. Establish appropriate Sectors/Groups.

B. OPERATIONS

1. CONDUCT A SITE SURVEY/SIZE - UP

a. Determine the nature, source, extent of problem.
b. Estimate incident level.
c. Determine need for evacuation.

2. FORMULATE/IMPLEMENT PLAN OF ACTION

a. Implement initial plan of action as described in the Emergency Response Guidebook and Hazard Action Guides.
b. Communicate plan of action to on scene personnel.
c. If necessary, implement alternate plans as information, personnel, resources and equipment are secured.

3. TERMINATE INCIDENT ACTIVITIES

a. Evaluate decontamination needs and support activities.
b. Establish disengagement / demobilization plan including post incident information and transfer of responsibilities.
c. Document remedial efforts during clean up operations.
d. Evaluate compliance with Fire Department regulations and directives and take appropriate enforcement action.

4. POST INCIDENT ANALYSIS

a. Conduct a post incident analysis and review.
b. Evaluate response re: Response plan.
c. Make recommendations.

C. PLANNING

1. EVALUATE HAZARDS AND ASSESS NEEDS

a. Determine strategic goals and tactical objectives.
b. Assess current status and intervention options.
c. Formulate, review, revise goals, objectives, action plan.

D. LOGISTICS

Assess logistical support requirements for incident activities.

E. FINANCE

Record all information re: costs involved in mitigating the incident incurred by the Fire Department.

4.2 **FIRST RESPONDERS (OPERATIONAL LEVEL) -** respond to the site for the purpose of protecting persons, property, or the environment from the effects of a hazardous materials release or potential release. They are not trained or equipped to use specialized chemical protective clothing or special control equipment. Their actions are limited to those which may be accomplished using SCBA and structural firefighter protective clothing as described in Department SOP and the Hazard Action Guides (HAG).

In the event that the public or any emergency responder has been exposed prior to recognition of a hazardous substance, those persons exposed should be isolated to avoid spreading any contamination and so that proper medical treatment and monitoring can be arranged. Those not exposed must be kept out of the contaminated area.

4.2.1 INITIAL ACTIONS

A. Given the limited capability of units arriving first at the scene of a hazardous materials release or potential release, premature commitment of companies and personnel to unknown, potentially hazardous situations/locations must be avoided.

B. Cautious, methodical, and deliberate size-up combined with immediate site security limits needless exposure of responding personnel and reduces the vulnerability of the public and the environment.

C. As soon as the presence of a hazardous substance is detected or suspected First Responders should take the following actions:

1. Use full structural firefighting clothing and SCBA as a minimum to protect themselves from unnecessary exposure to contaminants.
2. Isolate the hazard.
3. Control access to the hazard area.
4. Communicate available information to the IC or Dispatcher.
5. Alert other responders and call for assistance, if needed.
6. Establish an initial staging area for other responders.
7. Take steps to identify the hazard and evaluate the risk without endangering on scene personnel.
8. Consult Emergency Response Guidebook and Hazard Action Guides (HAG).

D. Whenever possible, first arriving units must alert other responding units of the hazardous nature of the incident by transmitting signal 10 - 80 with a brief description of known hazard information. This will prevent units from unknowingly responding into the hazard area.

E Develop a plan of action consistent with the Department's Emergency Response Plan and Hazard Action Guides for hazardous materials (HAG).

F. Implement the plan within the capability of the available personnel, protective clothing and equipment.

Note: The following assignments (Sections 4.2.2 through 4.2.6) are prescribed as standard procedure for units responding to a known or suspected hazardous materials incident. When the presence of a hazardous material is discovered during fire or other emergency operations, the Incident Commander must isolate units, redeploy or withdraw units and adjust the strategic and tactical objectives to address the hazard affecting the public and the operating emergency personnel.

Individual units must be assigned or reassigned to Hazard assessment, site control for public and personnel protection, and limited containment/confinement or isolation strategies as are possible. Given the limited capabilities of responders trained and equipped to the operational level this could include:

A. Withdrawing from or isolate selected areas.

B. Adjusting tactical objectives. Redeploy or reassign units and personnel.

C. Continuing current strategy, with additional resources called for specific assignments, e.g. the hazardous material problem.

The priorities should continue to be focused on limiting the exposure of personnel and the public; stabilizing the incident until additional resources are available to gain control; limiting the impact of the event by protecting property and the environment from additional harm.

4.2.2 FIRST ARRIVING LADDER COMPANY - HAZARD ASSESSMENT

The first arriving Ladder Co. is responsible for **Hazard Assessment**.

Some members of this company will be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and a radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the operational activities of these teams is to work alone.

A. OFFICER: Supervise hazard assessment activity of assigned members.

1. Obtains briefing from IC.
2. Assigns and instructs teams regarding hazard assessment activities and limitations.
3. Coordinates apparatus placement with other responding units.
4. Reports information to IC.
5. Monitors Handie-talkie/Radio.

B. LADDER CHAUFFEUR: Apparatus placement.

1. Positions apparatus out of the hazard area and as a barrier for site access control as ordered.
2. Coordinates apparatus placement with other responding units.
3. Remains with apparatus until further ordered.
4. Establishes physical barriers to area access using apparatus, barrier tape, traffic cones, traffic signs, etc., as ordered.
5. Monitors Handie-talkie/Radio.

C. TEAM 1: Hazard Identification.

1. Identify occupancy and location hazards, if possible.
2. Identify Container shape and approximate size, if possible.
3. Identify any visible markings, colors, placards/labels, etc.
4. Report information available and stand-by.
5. Monitor Handie-talkie.

D. TEAM 2: Information resources.

1. Access HAG & DOT GUIDEBOOK locating appropriate Guide, isolation and evacuation recommendations.
2. Confirm Guide Number, isolation distance, and evacuation information with Second Arriving Ladder Co..
3. Report information to Officer.
4. Monitor Handie-talkie.

4.2.3 SECOND ARRIVING LADDER COMPANY - SITE ACCESS CONTROL

The second arriving Ladder Co. is responsible for **Controlling Access** to the site and for establishing the initial exclusion area. Some members of this company will be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and a radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the operational activities of these teams is to work alone.

A. OFFICER: Coordinate / limit site access.

1. Obtains briefing from IC.
2. Assigns and instructs teams regarding hazard assessment activities and Limitations.
3. Advises IC re: need for Police assistance in area security and control.
4. Reports information to IC.
5. Monitors Handie-talkie/Radio.

B. LADDER CHAUFFEUR: Apparatus placement.

1. Positions apparatus out of the hazard area and as a barrier for site access control as ordered.
2. Coordinates apparatus placement with other responding units.
3. Remains with apparatus until further ordered.
4. Establishes physical barriers to area access using apparatus, barrier tape, traffic cones, traffic signs, etc., as ordered.
5. Monitors Handie-talkie / Radio.

C. TEAM 1: Information resources.

1. Using information from the first arriving ladder company or the IC, access HAG & DOT GUIDEBOOK locating appropriate Guide, isolation and evacuation recommendations.
2. Confirm Guide Number, isolation distance, and evacuation information with First Arriving Ladder Co.
3. Report information to Officer.
4. Monitor Handie-talkie.

D. TEAM 2: Initial Isolation Zone

1. On orders of the Officer establish physical barriers as an initial isolation/exclusion zone using barrier tape, utility rope, traffic cones, etc., as ordered.
2. Remain outside isolation zone to deny access until relieved or as ordered.
3. Monitor Handie-talkie.

4.2.4 FIRST ARRIVING ENGINE COMPANY - WATER SUPPLY

The first arriving Engine will **Establish The Initial Water Supply**.

Based on the existing conditions, a line should be stretched but not placed into operation until ordered by the IC. pending the outcome of the initial hazard assessment. The premature, unnecessary, or incompatible use of water can compound the hazard. The unit will stand-by out of the hazard area.

Members of this unit will remain together as a unit unless otherwise ordered by the Incident Commander to perform duties appropriate to specific tactical objectives. This might include such things as assisting in site control or evacuation.

If and when necessary, some members of this company may be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the operational activities of these teams is to work alone.

A. OFFICER: Supervise hazard assessment activity of assigned members.

1. Obtains briefing from IC.
2. Assigns and instructs teams regarding hazard assessment activities and limitations.
3. Supervises water supply and line placement activities.
4. Coordinates apparatus placement with other responding units.
5. Reports information to IC.
6. Monitors Handie-talkie/radio.

B. ENGINE CHAUFFEUR: Apparatus placement.

1. Positions apparatus out of the hazard area.
2. Establishes a water supply.
3. Coordinates apparatus placement with other responding units.
4. Remains with apparatus until further ordered.
5. Establishes physical barriers to area access using apparatus, barrier tape, traffic cones, traffic signs, etc., as ordered.
6. Monitors Handie-talkie/radio.

4.2.5 SECOND ARRIVING ENGINE COMPANY - SITE ACCESS CONTROL

The second arriving Engine Co. is responsible for assisting and coordinating with the second ladder company to **Control Access** to the site.

Members of this unit will remain together as a unit unless otherwise ordered by the Incident Commander to perform duties appropriate to specific tactical objectives. This might include such things as assisting the first arriving Engine in water supply or line placement, site control or evacuation.

If and when necessary, some members of this company may be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and a radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the operational activities of these teams is to work alone.

A. OFFICER: Assist Second Ladder Co. in SITE CONTROL.

1. Obtains briefing from IC.
2. Assigns and instructs teams regarding hazard assessment activities and limitations.
3. Coordinates site activities with other units engaged in site control.
4. Reports information to I.C.
5. Monitors Handie-talkie/Radio.

B. ENGINE CHAUFFEUR: Apparatus placement.

1. Positions apparatus out of the hazard area and as a barrier for site access control as ordered.
2. Coordinates apparatus placement with other responding units.
3. Remains with apparatus until further ordered.
4. Establishes physical barriers to area access using apparatus, barrier tape, traffic cones, traffic signs, etc., as ordered.
5. Monitors Handie-talkie/radio.

4.2.6 OTHER UNITS ON INITIAL ALARM

Members of these units will remain together as a unit unless otherwise ordered by their Officer as directed by the Incident Commander to perform duties appropriate to specific tactical objectives. This might include assisting other units in site control or evacuation.

If and when necessary, members of these companies may be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and a radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the operational activities of these teams is to work alone.

A. THIRD ARRIVING ENGINE CO.

1. Reports to Incident Commander.

a. Obtain briefing from IC.
b. Assigns and instructs teams regarding hazard assessment activities and limitations.
c. Coordinates apparatus placement with other responding units.
d. Reports information to IC.

2. Stands-by to assist other responders as directed by the IC.
3. Monitors Handie-talkie/radio.

B. RESCUE CO., SQUAD, OTHER UNITS, Etc.

1. Report to Incident Commander.

a. Obtain briefing from IC.
b. Assign and instruct teams regarding hazard assessment activities and limitations.
c. Coordinate apparatus placement with other responding units.
d. Report information to IC.

2. Stand-by to assist other responders as directed by the IC.
3. Monitor Handie-talkie/radio.

C. ADDITIONAL UNITS

Additional units responding to the scene of a known hazardous materials incident should be given specific information regarding the location of staging areas and tactical objectives assigned to the unit. If, due to the nature of the event, the Officers of the responding units do not receive this information, they should:

1. Request this information from the dispatcher.
2. Keep their units intact and establish contact with the next higher level of supervision.
3. Members of the units will remain together as a unit unless otherwise ordered by their Officer who is directed by the Incident Commander to perform duties appropriate to specific tactical objectives. If and when necessary, members of these companies may be divided into teams, each team equipped with at least one radio. The Officers of these units will designate team members and a radio contact person.

4.3 **HAZARDOUS MATERIALS GROUP -** Individuals who respond to releases or potential releases for the purpose of stopping or controlling them. They assume a more aggressive role than a first responder at the operational level in that they will approach the point of the release. Their duties require a more directed or specific knowledge of the various substances they may be called upon to contain. Their training includes knowledge of procedures for the use of specialized chemical protective clothing, survey equipment, and special procedures for containing a chemical hazard and decontamination.

Some members of the Hazardous Materials Unit will be divided into teams, each team equipped with at least one radio. The Officer of this unit will designate team members and the radio contact person.

The purpose of the team concept is to provide for the safety and accountability of all the members. No person involved in the mitigation activities of these teams is to work alone.

The Haz-Mat Group consists of the Hazardous Materials Unit and members of the Special Operations Command. Each has a specific role and objective to accomplish at an incident. They are generally described as follows:

A. Analysis

1. Verify, identify, or classify hazardous materials and determine their concentration.
2. Collect and interpret hazard and response information.
3. Estimate damage to containment systems.

B. Planning

1. Select appropriate PPE for incident activities.
2. Develop decontamination procedures.
3. Develop plan of action consistent with the ERP and within the capability of the personnel, PPE, and equipment available.

C. Operations

1. Carry out planned activities under the direction of the IC as per the ERP.

4.3.1 **HAZ-MAT GROUP SUPERVISOR -** On duty Officer of Hazardous Materials Unit who will supervise the "hands-on" mitigation operation. He will coordinate the following activities as directed by and report to the IC or a level of supervision assigned by the IC as per FDNY-ICS.

A. Obtains briefing from the Incident Commander.

B. Confirms the development of Control Zones and Access Control Points and the placement of appropriate control lines.

C. Ensures that a Site Safety Plan is developed and implemented.

D. Participates in the development of the Incident Action Plan; Develops the Hazardous Materials portion of the Incident Action Plan.

E. Evaluates and recommends evacuation, sheltering, and decontamination options to the Incident Commander.

F. Conducts safety meetings with the Hazardous Materials Unit members. The Hazardous Materials Group Supervisor is responsible for site safety and operations inside the area bounded by the Contamination Control Line including the Exclusion Area or "Hot Zone".

G. Ensures that the proper Personal Protective Equipment is selected and used.

H. Ensures that current weather data and future weather predictions are obtained.

I. Supervises the activities of and maintains communications with:
   1. Haz-Mat Unit Team members.
   2. Incident Commander or next higher level of supervision, if a position has been staffed.

J. Establishes environmental monitoring of the hazard site for contaminants.

K. Ensures that appropriate agencies are notified through the Incident Commander.

L. Terminates operations.

4.3.2 **ENTRY TEAM -** The Entry Team consists of a minimum of two members assigned to the Haz-Mat Unit. One member will be designated the Team Leader. The Team Leader will, on orders from the Haz-Mat Group Supervisor, perform the following functions:

A. Obtain briefing from the Hazardous Materials Group Supervisor.

B. Supervise entry operations.

C. Recommend actions to mitigate the situation within the Exclusion Zone.

D. Carry out actions, as directed by the Hazardous Materials Group Supervisor, to mitigate the hazardous materials release or threatened release.

E. Maintain communications and coordinate operations with:
   1. Hazardous Materials Group Supervisor.
   2. Decontamination Team Leader.
   3. Resource Technician / Hazardous Materials Reference.
   4. Back-up Team.

F. Maintain control of the movement of people and equipment within the Exclusion Zone, including contaminated victims.

G. Direct rescue operations, as needed, in the Exclusion Zone.

H. Terminate operations.

4.3.3 **BACKUP TEAM -** The Backup Team consists of a minimum of two members assigned to the Haz-Mat Unit. One member will be designated the Team Leader. The Team Leader will, on orders from the Haz-Mat Group Supervisor, perform the following functions:

A. Obtain briefing from the Hazardous Materials Group Supervisor.

B. Assist Entry Team in site survey and product identification.

C. Carry out actions as directed by the Hazardous Materials Group Supervisor.

D. Ensure all equipment is prepared for use according to action plan.

E. Maintain sight contact with Entry Team whenever possible.

F. In proper PPE, act as a backup Entry Team from safe area. Be prepared to rescue the Entry Team.

G. Complete operations in Exclusion Zone should Entry Team fail to complete assignment.

H. Maintain communications and coordinate operations with:
   1. Entry Team Leader.
   2. Hazardous Materials Group Supervisor.
   3. Resource Technician / Hazardous Materials Reference.
   4. Decon Team Leader.

I. Furnish additional equipment or supplies to the Entry Team as needed. Replace equipment used.

J. Terminate operations.

4.3.4 **DECONTAMINATION (DECON) TEAM -** The Decon Team consists of a minimum of two members assigned to the Haz-Mat Unit. One member will be designated the Team Leader. The Team Leader will, on orders from the Haz-Mat Group Supervisor, perform the following functions:

A. Obtain briefing from the Hazardous Materials Group Supervisor.

B. Manage the Control Zones and Access Control Points and the placement of appropriate control lines.

C. Ensure appropriate action is taken to prevent spread of contaminants.

D. Set up Decon area. Implement decontamination process of Haz-Mat Team.

E. Decon, as possible, all equipment used.

F. Maintain communications and coordinate operations with:
   1. Entry Team Leader.
   2. Hazardous Materials Group Supervisor.
   3. Resource Technician / Hazardous Materials Reference.
   4. Back-up Team.

G. Overpack exposed equipment for further decontamination or disposal.

H. Ensure that all equipment is placed back in service.

I. Terminate operations.

4.3.5 **RESOURCE TECHNICIAN -** A member of the Haz-Mat Unit designated to provide technical information and assistance to the Hazardous Materials Group using various reference sources such as computer data bases, technical library, CHEMTREC, and phone contact with facility representatives.

The Resource Technician may provide product identification using tests kits and/or any other means of identifying unknown materials.

The Resource Technician will, on orders from the Haz-Mat Group Supervisor, perform the following functions:

A. Obtains briefing from the Hazardous Materials Group Supervisor.

B. Provides support to the Hazardous Material Group Supervisor.
   1. Monitors SCBA use time for suit operations.
   2. Determines personal protective equipment compatibility to hazardous material.

C. Maintains communications and coordinate operations with:
   1. Entry Team Leader.
   2. Hazardous Materials Group Supervisor.
   3. Back Up Team Leader.
   4. Decon Team Leader.

D. Provide technical information management with public and private agencies. Interpret environmental monitoring information.

E. Provide analysis of hazardous material samples.

F. Document operations and notifications. E.g. Document serial numbers of chemical protective suits worn by members.

G. Provide technical information of the incident for documentation.

H. Determine proper decon requirements.

I. Complete all necessary reports and forms and terminate operations.

4.3.6 **SPECIAL OPERATIONS DECON OFFICER -** member of Special Operations Command assigned to the Hazardous Materials Group designated responsible for on-site and off site decontamination. The SOC Decon Officer will respond upon the request of the Incident Commander. The SOC Decon Officer reports directly to the Incident commander. The SOC Decon Officer supervises the SOC Decon Team.

The SOC Decon Officer, as directed, will:

A. Obtain briefing from IC, advise IC of decon needs, and formulate plan of action. The Decon procedure to be followed will be determined by DEP, and the SOC Decon Officer.

B. Identify items of equipment and clothing to be decontaminated.

C. Establish a Decon area.

D. Supervise the set-up and operation of all tools and equipment required for the decon procedure.

E. Arrange for collection, transportation, storage, cleaning, and temporary replacement of exposed or contaminated equipment.

F. Insure proper disposition of all processed items.

Procedures and documentation for this phase of operations will be as per policy developed by the Special Operations Command. See Section 5.3, for information on the Decon process.

The SOC Decon Officer will respond with the Decontamination Support Vehicle and the SOC Decontamination Team. Decontamination will, if possible, be accomplished at the scene to place apparatus, clothing and equipment back in service. If this is not possible, decontamination will be conducted at a time and site designated by the SOC Decon Officer.

4.3.7 **SPECIAL OPERATIONS COMMAND DECON TEAM -** consists of members assigned to Special Operations Command. They report directly to the SOC Decon Officer.

The SOC Decon Team is trained and designated by the Fire Department to perform decontamination of apparatus, tools, and equipment. They are qualified to execute specific procedures and operate decontamination equipment wearing the protective clothing and respiratory protection appropriate to the hazardous substance being processed.

5. SAFE WORK PRACTICES

5.1 GENERAL PROCEDURES

The following work practices must be enforced to ensure a safe work-site for all personnel.

A. Always consider the possibility that hazardous materials may possess multiple hazards.

B. Use full structural firefighting clothing and SCBA as minimum protection from unnecessary exposure to contaminants.

C. Each member should be alert to the signs, evidence and indications of the presence of hazardous substances during fires and emergencies and report such information to the next higher level of command.

D. If and when necessary, members may be divided into teams, each team should be equipped with at least one radio. The Officer of the unit will designate team members and radio contact person.

E. Mark all work zones and access points with barricade tape, flagging, or traffic cones.

F. Access to the site should remain free of unnecessary equipment and apparatus to facilitate other types of emergency access to and egress from the site.

G. Persons entering or leaving a work zone must check in/out at the access control point.

H. Access and means of egress must be secured and protected for the safety of persons in work zones. Doors, stairways and ladders should be secured. Ramps, ditches and excavations should be made as secure as possible in the event that rapid escape is required from the site.

I. No eating, drinking, or smoking is allowed in any contaminated area.

J. Implement decontamination based on an analysis of the hazards and risks involved.

(See Decontamination Section 5.3)

5.2 WORK ZONES

The method of reducing the potential for transfer of contamination is to delineate work areas within the incident site based upon expected or known levels of contamination. Within the areas assigned, personnel will utilize appropriate personal protective equipment. Movement between areas is controlled at checkpoints. Three contiguous areas will be established.

A. Exclusion area (contaminated) - "HOT ZONE"

B. Contamination reduction area - "WARM ZONE"

C. Support area (non-contaminated) - "COLD ZONE"

5.2.1 **EXCLUSION AREA - HOT ZONE**

The Exclusion Area is the inner most area and is considered contaminated or "hot". Within the Exclusion Area, prescribed levels of protection must be worn by all entering personnel. A check point must be established at the periphery of the Exclusion Area to control the flow of personnel and equipment between contiguous areas and to insure that the procedures established to enter and exit the areas are followed.

The Exclusion Area boundary would be established initially based on the type of released/spilled materials, initial instrument readings, and a safe distance from any potential exposure.

Subsequently, the boundary may be readjusted based on additional observation and/or measurements. The area should be physically secured by barrier tape into well-defined boundaries.

In the event that the public or any emergency responder has been exposed prior to recognition of a hazardous substance, those persons exposed should be isolated to avoid spreading any contamination and so that proper medical treatment and monitoring can be arranged.

Those not exposed must be kept out of the contaminated area.

Unless otherwise demonstrated, everything leaving the Exclusion Area should be considered contaminated and appropriate methods established for decontamination should be implemented.

5.2.2 **CONTAMINATION REDUCTION AREA - WARM ZONE**

Between the Exclusion Area and the Support Area is the Contamination Reduction area. The purpose of this zone is to provide an area to prevent or reduce the transfer of contaminants which may have been picked up by personnel or equipment returning from the Exclusion Area. All decontamination activities occur in this area.

The boundary between the Support Area and the Contamination Reduction Area is the "Contamination Control Line". This boundary separates the possibly contaminated area from the clean zone. Entry into the Contamination Reduction Area from the clean area will be through an access control point. Personnel entering at this location will be wearing the prescribed level of protection for working in the Contamination Reduction Area. Exiting the Contamination Reduction Area to the clean area requires the removal of any suspected or known contaminated protective clothing and/or equipment and that appropriate decontamination procedures be followed.

At the boundary between the Contamination Reduction Area and the Exclusion Area is the "Hot Line" and access control station. Entrance into the Exclusion Area requires the wearing of the prescribed chemical protective clothing which may be different than the equipment requirements for working in the Contamination Reduction Area.

At a point close to the "Hot Line", a personnel and/or equipment decontamination station is established for those exiting the Exclusion Area. Unless otherwise demonstrated, everything leaving the Exclusion Area should be considered contaminated and appropriate methods established for decontamination should be implemented.

5.2.3 SUPPORT AREA - COLD ZONE

The Support Area is the outermost area of the site and is considered a non-contaminated or "clean" area. It is designated as a controlled area for authorized support personnel and the location for support equipment (Command Post, Equipment, etc.). Since normal firefighting clothing are appropriate within this zone, potentially contaminated personnel clothing, equipment, etc., are not permitted.

5.2.4 AREA DIMENSIONS

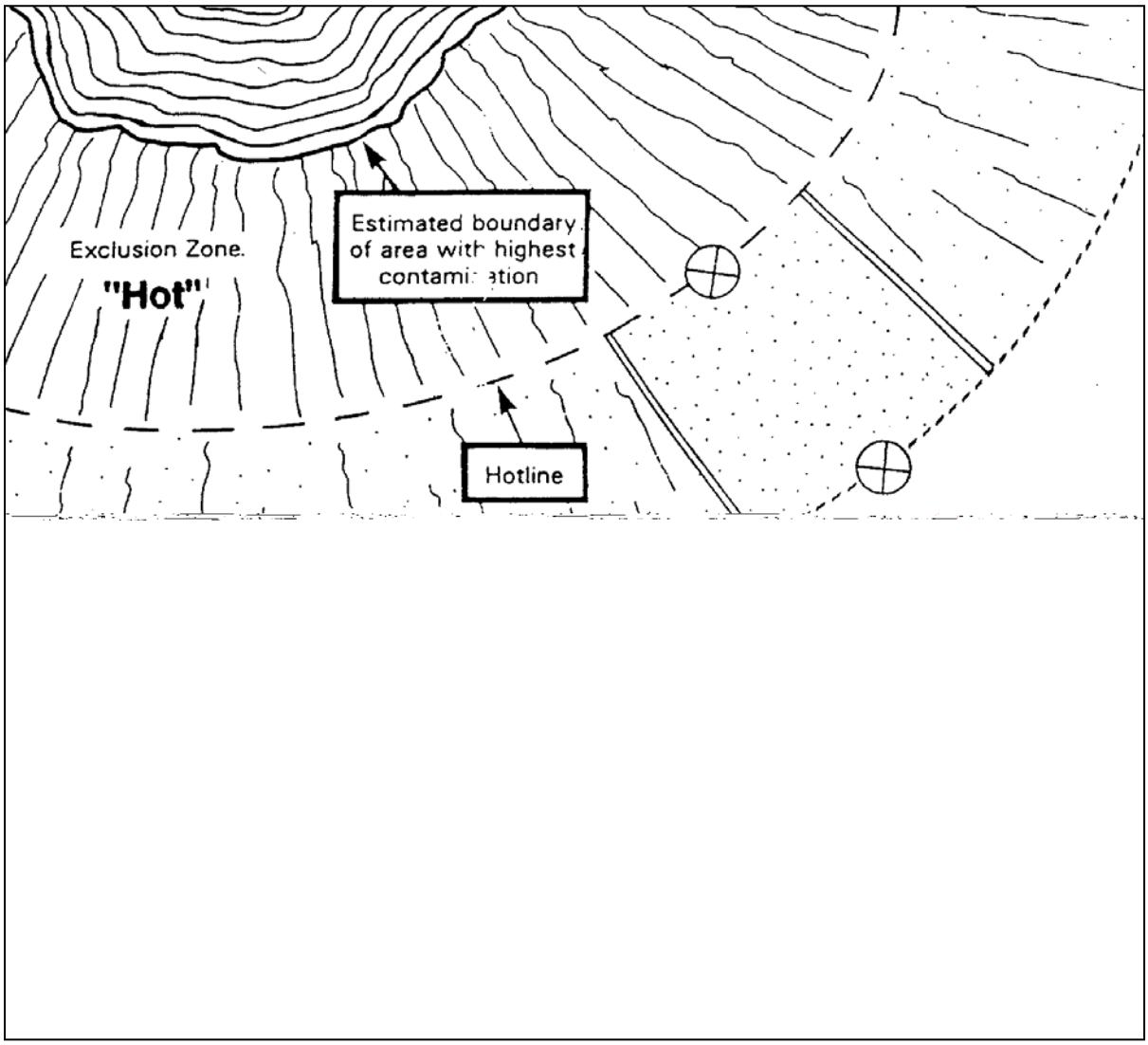
Considerable judgment is needed to assure safe working distances for each area balanced against practical work considerations. During long term operations zones may be adjusted.

The following criteria are to be considered in determining the area dimensions:

A. Physical and topographical barriers;
B. Weather conditions;
C. Monitoring measurements;
D. Explosion/exposure potential;
E. Physical, chemical, toxicological, etc., characteristics of the contaminant(s); and
F. Clean-up activities.

5.2.5 OTHER CONSIDERATIONS

The use of a three-zone system of area designation, access control points and exacting decontamination procedures provides a reasonable assurance against the translocation of contaminating substance. This control system is based on a "worst case" situation. Less stringent site control and decontamination procedures than described may be utilized based upon more accurate information concerning the types of contaminants involved and the contaminating hazards they present. This information can be obtained through air monitoring, instrument survey, etc., and technical data concerning the characteristics and behavior of material present. Site control requirements can be modified within the limits of safety for specific situations once more reliable data has been analyzed.


Exclusion Zone
"Hot"
Estimated boundary of area with highest contamination
Hotline

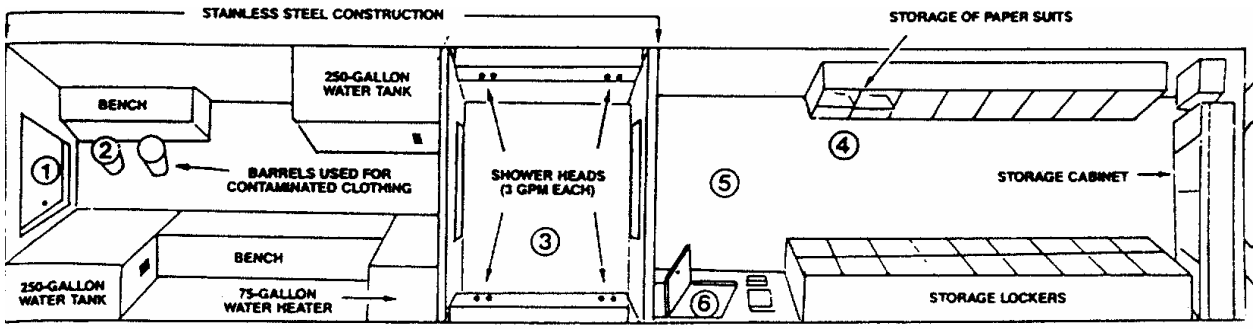
5.3 DECONTAMINATION PROCEDURES

As part of the system to prevent or reduce the physical transfer of contaminants by people and/or equipment from the site, procedures will be instituted for decontaminating anything leaving the Exclusion Area and Contamination Reduction Area. These procedures include the decontamination of personnel, protective equipment, monitoring equipment, clean-up equipment, etc.

In the event that the public or any emergency responder has been exposed prior to recognition of a hazardous substance, those persons exposed should be isolated to avoid spreading the contamination and so that proper medical treatment and monitoring can be arranged.

Those not exposed must be kept out of the contaminated area.

5.3.1 The FDNY maintains a Hazardous Materials Decontamination Unit. The Unit consists of the Decon trailer and a support unit. The Police Department has a similar unit that can be utilized as a backup. (See Diagram below)



① FIREFIGHTER ENTERS ② DROPS CLOTHING ③ SHOWERS
④ PUTS ON PAPER SUIT ⑤ UNDERGOES MEDICAL EXAM ⑥ EXITS

5.3.2 The following steps have been designed to deal with personnel decontamination in worst case incidents. In some situations it will not be necessary to go through the entire procedure. The decision to implement all or part of the decontamination process should be based on a field analysis of the hazards and risks of the hazardous materials involved. The FDNY Hazardous Materials Unit and the N.Y. City Departments of Health and Environmental Protection supply the toxicological and reactivity information that determines which techniques apply.

Step 1: An "entry point" will be established and marked in order to guide contaminated personnel into the DECON area.

Step 2: Protective clothing will be removed and isolated.

Contaminated coats, helmets, etc., should be placed in plastic bags to isolate contaminants. Bagged clothing should be sealed and placed in recovery drums outside the trailer for further analysis and for transportation to another location for laundering or disposal.

Step 3: Members enter the rear of the Decon Unit. EMS personnel will supervise the decon procedures. All personal effects and work clothing are removed and placed in bags and drums.

Step 4: In almost all cases, members will shower for a period determined by the type of substance involved. The exceptions occur when the substance involved is one made more active by water.

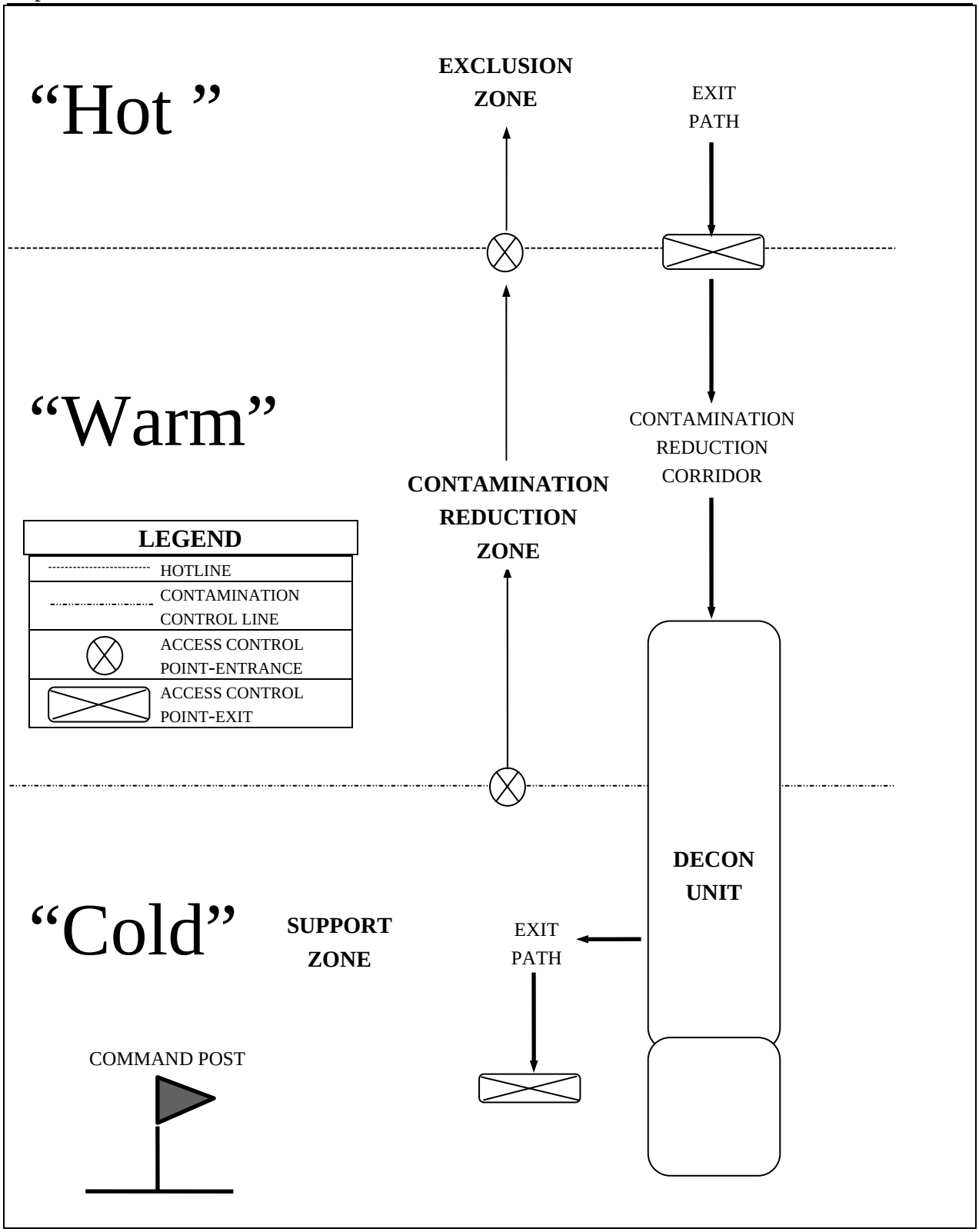
Step 5: After showering, members are issued towels and clothing to enable them to proceed to areas designated by EMS personnel. Members exit Decon Unit.

Step 6: EMS personnel examine members taking a medical history, checking vital signs, and follow up on any physical complaints. This will usually take place in the EMS MERVAN on the clean side or Support Zone.

Step 7: Any members that require further evaluation or treatment will be transported by EMS.

Step 8: The Decon Unit will disconnect and store the unit's equipment and apparatus.

Step 9: Waste water from the showers will be analyzed by DEP.


"Hot "
EXCLUSION ZONE
EXIT PATH
"Warm"
CONTAMINATION REDUCTION CORRIDOR
CONTAMINATION REDUCTION ZONE
LEGEND
HOTLINE
CONTAMINATION CONTROL LINE
ACCESS CONTROL POINT-ENTRANCE
ACCESS CONTROL POINT-EXIT
DECON UNIT
"Cold"
SUPPORT ZONE
EXIT PATH
COMMAND POST

5.3.3 A member of the Special Operations Command will Identify apparatus, equipment and clothing to be decontaminated.

All clothing, personal items, apparatus, tools and equipment will remain at the site pending this determination.

The Special Operations Command (SOC) will arrange for the collection, removal, transportation, storage, cleaning, and temporary replacement of exposed or contaminated clothing and equipment.

On receipt of members' original clothing, Company Commanders will contact SOC to arrange return of replacement clothing.

6. INCIDENT COMMAND SYSTEM FUNCTIONS AND RESPONSIBILITIES

Note: These activities are specific to hazardous materials incidents and are in addition to the usual requirements of each position. This does not restrict the IC from staffing other ICS positions or from specifying additional duties that might be required by the incident.

ANY FUNCTIONS NOT DELEGATED REMAIN THE RESPONSIBILITY OF THE INCIDENT COMMANDER.

6.1 SAFETY - reports directly to the Incident Commander.

The Safety Operating Battalion will respond to all 10-80 code 2 signals (Level 2 or 3 incidents) and as requested by the Incident Commander. At a hazardous materials incident, they will monitor conditions and activities in the Support Zone (Cold Zone).

The Safety Operating Battalion Chief at the scene is also designated to confirm that all exposed members participate in the decontamination procedure conducted by the Decon Team and the Special Operations Decon Officer. If for any reason the Safety Operating Battalion does not respond to the scene, the Special Operations Decon Officer will perform this function.

The Safety Chief is responsible for recording the name, rank, Social Security number and unit identification of all members decontaminated with a description of the decontamination procedures employed.

The Safety Chief designated will, as soon as practicable after the incident, forward a report to the Bureau of Health Services and the Bureau of Operations. See "Reports" Section 10.2.

6.1.1 The Hazardous Materials Group Supervisor is responsible for site safety and operations inside the area bounded by the Contamination Control Line including the Exclusion Area or "Hot Zone".

6.2 **INFORMATION - reports directly to the Incident Commander.**

The Fire Department Public Information Office will be notified upon transmission of signal 10-80 code 2 (Level 2 or 3 incident).

Firefighters should not make any statements to anyone outside the F.D. chain of command about the character or nature of a hazardous materials incident. Inquiries should be directed to the Incident Commander or Information Officer, if the position has been staffed.

Information to the public will be released in conjunction with the Office of the Mayor as per the NYC Response Plan.

6.3 **LIAISON - reports directly to the Incident Commander.**

This is a senior Fire Department Officer who is the contact point for representatives of assisting and cooperating agencies. The Liaison has the authority given by the IC to commit Fire Department resources to specific incident activities and support functions.

The Liaison assists the IC in assigning Technical Specialists to appropriate functions within ICS.

6.4 **OPERATIONS CHIEF - reports directly to the Incident Commander.**

The Operations Chief directs, coordinates and controls all tactical activities and functions necessary to carry out the objectives of Command. Reports directly to the Fire Department IC.

A. **Responsibilities of the Operations Chief.**

1. Directs the management of all Fire Department on-scene tactical efforts needed to gain control of the incident.

2. Works directly with the Fire Department IC and the On-Scene Coordinator developing both primary and alternative strategies.

3. Determines operational necessities and request additional support when required.

4. Establishes Sectors and Groups as determined by operational needs.

5. Assigns objectives to Sector and Group Supervisors.

6. Reports changing conditions to the IC.

7. Supervises the Staging Area Manager.

6.4.1 **TECHNICAL SPECIALISTS (Assigned to Operations)**

May be assigned by Command or Liaison Officer to advise or assist in the tactical activities under the direction of the Operations Chief.

6.5 **PLANNING CHIEF - reports directly to the Incident Commander.**

A. Gathers, evaluates, disseminates information for the development of alternative strategies.

B. Maintains records of incident activities for analysis and review, tracks current resource and situation status.

C. Establishes and maintains communications network.

6.5.1 **RESOURCE AND SITUATION STATUS**

This function will include preparation and maintenance of a Command and Control Chart as part of the overall site safety plan.

A. The Chart should identify the topographic features of the site, prevailing wind direction, drainage, location of buildings, physical barriers, tanks, etc. This information is helpful in:

1. Planning activities.

2. Assigning personnel.

3. Identifying access routes, evacuation routes, and any problem areas.

4. Identifying areas at the site that require the use of personal protective equipment.

5. As a visual aid during briefing of on site emergency personnel.

B. The Chart should be updated throughout the course of the operation and should reflect:

1. Changes in site activities;

2. Hazards not previously identified;

3. Weather conditions; and

4. Activities of other agencies on site.

6.5.2 **TECHNICAL SPECIALISTS (Assigned to Planning)**

A. May be assigned by Command or Liaison Officer in an advisory capacity from various parties and agencies with interest or jurisdiction. These might include representatives of the material owner/shipper, chemists, field monitoring personnel from other agencies, code and regulation enforcement officials, members of City agencies with expertise or resource capability of a unique nature.

They will supply technical information, data interpretation, sample analysis, forecasts, etc.

B. Persons assigned at this level generally do not have decision making authority for their particular agency unless specifically authorized. They act in an advisory capacity for incident planning.

C. Information gathered will be used by Command and Operations Chief for the development and execution of various incident activities.

6.5.3 **DOCUMENTATION**

A. The IC will designate a member to keep a Log. Log sheets have been supplied to all Divisions, Battalions, and the Haz/Mat Unit. The Log should be retained by the Fire Department IC.

Records of these incidents are always important but especially when the incident results in personal injury, property damage or damage to the environment.

B. Certain events require more complex documentation. These incidents include but are not limited to:

1. Prolonged multi-agency operation.
2. Multiple changes at the Command level.
3. Major events involving several jurisdictions, private corporations, public utilities, etc.
4. Events involving high risk operations.
5. Multiple injuries or mass exposure.
6. Extensive isolation or evacuation of the public or public areas.
7. Isolation or contamination of environmentally sensitive areas or facilities.

C. Transcripts of this information can be taken from video tapes, photographs, and sound recordings made during the event or from notes kept in a bound log book (not loose-leaf). Log books are carried in each Command Chief's car and in the Field Communications Unit.

D. All information should be recorded objectively. Each person making an entry should date and sign the document. The number of persons recording the information should be kept to a minimum.

E. Entries should be made in a timely way to insure accuracy and thoroughness. Neatness and legibility are essential.

F. The following information should be recorded:

1. Chronological history of the event.

2. Facts about the incident and when they became available including names, descriptions, source, quantity, and cause of release, if known.

3. Names and assignments of key personnel and resources.

4. Actions, decisions, orders and directions given: by whom, to whom, and when.

5. Actions taken: who did what, when, where, and how.

6. Possible exposure of personnel.

7. Records of all injuries and illnesses during, or as a result of, the emergency.

6.6 LOGISTICS CHIEF - reports directly to the Incident Commander.

A. Logistics is the procurement, distribution, maintenance of facilities, services, materials and personnel to support the incident.

B. The Service and Support functions would include the following responsibilities:

1. Service
   a. Fire Department Medical Officer:
      1. Determine a site for medical facilities.
      2. Assist in setting up and recording the transportation of the injured.
      3. Provide medical treatment for Fire Department personnel.
   b. Facilities
      1. Assist in the operation of the Command Post, recuperation and care areas and secondary staging for apparatus. Procuring shelter facilities for personnel.

2. Support

a. Mask Service

Supply air cylinders or air lines.

NOTE: **POTENTIALLY CONTAMINATED CYLINDERS MUST NOT BE EXCHANGED.**

b. Special Units (Supplies)

1. Order and supply specialized extinguishing agents (CO2, Foam, Dry Powder etc.).
2. Order and supply diking, absorbent, or neutralizing materials.
3. Facilitate specialized tools or heavy duty equipment (shoring, cranes, etc.), pumps, etc.

c. Fleet Maintenance

1. Repair and refueling of vehicles at extended operations.
2. Supply vehicles for transportation.

C. Liability, costs to the provider, and the availability of certain types of equipment preclude irregular or informal arrangements for the procurement of equipment and supplies. (See Emergency Equipment, Section 3.8)

6.6.1 TECHNICAL SPECIALISTS (Assigned to Logistics)

Members from the Special Operations Command (SOC) will respond to the scene of each event that requires Decontamination to supervise and facilitate the procedure for collecting, documenting, and tracking clothing and equipment that is to be confiscated and replaced.

Procedures and documentation for this phase of operations will be as per Department publications.

(See Hazardous Materials Group, Section 4.3.6, 4.3.7, 4.3.8)

6.7 FINANCE

Cost recovery/Restitution from the party responsible for the incident or recovery from governmental funding, involves documenting all information pertinent to the costs involved in mitigating the incident incurred by the Department or the City. All costs must be documented and supported with written materials such as damage reports, time records, receipts and invoices.

7. INTERAGENCY SUPPORT SYSTEM - As part of the response system various agencies will be notified and will respond based on the specific nature of the incident. It is essential that each responder be familiar with New York City's broader plan for response to a hazardous materials emergency since each agency has a specific role in the total response.

The following agency resources are available and will respond as needed and according to the NYC Hazardous Materials Response Plan. Their duties include but are not necessarily limited to the following:

A. OFFICE OF EMERGENCY MANAGEMENT (OEM), Police Dept.

Coordinate all City agency activities.
Coordinate evacuation, if necessary.
Consult with Dept. of Environmental Protection Response Team and Poison Control Center to evaluate the extent of the hazard.
Staff and support Interagency Command Center (ICC).
Contact and maintain liaison with NY State Office of Emergency Management.

B. ON SCENE COORDINATOR (OSC), Police Dept.

Establish Interagency Command Center (ICC).
Establish Communications capability between the site and the ICC.
Establish and maintain overall site security.
Coordinate all on site personnel.
Direct activities of Police Dept. Operations Unit.
Coordinate and select Emergency Response Routes.
Coordinate "off loading", if necessary.

C. POLICE DEPARTMENT, (PD)

Control traffic and emergency vehicle access in site vicinity.
Crowd control and evacuation, if appropriate.
Provide central information and notification center for all City agencies.

D. DEPT. OF ENVIRONMENTAL PROTECTION (DEP)

Dispatch response Team to provide technical personnel and equipment.
Sample and analyze substances and the environment.
Gather information, provide technical guidance to OEM.
Obtain financial approval for and arrange private sector containment, control, clean up, and disposal of hazardous materials, where necessary.

E. SANITATION DEPARTMENT

Maintain/supply materials for containment and confinement operations.
Clean up and disposal of materials (except liquids) rendered harmless as determined by DEP and Health Dept.
Investigate/enforce environmental/dumping regulations.

F. DEPARTMENT OF HEALTH

Provide technical information on materials hazards.
Assess effects to public health.
Provide informational/precautionary press statements concerning public health.
Ensure proper mitigation and disposal of radioactive and etiological agents.

G EMERGENCY MEDICAL SERVICES (EMS)

On site medical services.
Assist in Fire Department decontamination.

H. DEPARTMENT OF TRAFFIC

Facilitate and control traffic flow in area.

I. MAYOR'S PRESS OFFICE

Exclusive authority for public information and warnings.

8. INCIDENT TERMINATION PROCEDURES

8.1 CLEAN UP OPERATIONS

Incident scene activities include removing the hazardous material, all contaminated debris (including dirt, water, containers, vehicles, tools and equipment) and returning the scene to as near normal as it existed prior to the incident.

Clean up operations are not a Fire Department function. However, assuring that this clean up takes place is a responsibility of the Fire Department.

The Fire Department will cooperate with the Department of Environmental Protection (DEP) in arranging clean up activities. The Senior representative of DEP will arrange for authorization to obtain financial approval for and arrange private sector containment, control, clean up, and disposal of hazardous materials, where necessary.

In some cases, the Hazardous Materials Unit will take samples of materials for testing. These samples will be picked up by DEP to be tested and analyzed. Under no circumstances is any Fire Department unit, including the Hazardous Materials Unit, to transport these samples or any hazardous material, even if properly contained, to any Fire Department location or facility or other location or agency.

If operations are concluded and DEP has not arrived at the scene, these samples will remain at the scene for pick up by DEP. The Police Department representative at the scene will safeguard these samples. If the Police Department is not represented at the scene the Police Dept. Operations Unit should be contacted through the dispatcher. The Fire Department IC should request priority response and be prepared to give all particulars regarding the need for Police assistance.

The Hazardous Materials Unit shall not be detained at the scene for purposes of safeguarding materials after control and containment of the substance has been completed.

Arrangements for the collection, transportation, cleaning, and temporary replacement of exposed or contaminated Fire Department equipment shall be the responsibility of the Special Operations Decon Officer at the scene. (See 4.3.6)

8.2 Prior to leaving the scene, the IC shall review the particulars of the incident to make a preliminary determination regarding compliance with fire prevention regulations and directives. Non-compliance should be addressed through violation orders, summonses, vacate orders etc. If necessary, consult the Bureau of Fire Prevention for assistance.

Additionally, within ten (10) days from the completion of the post incident review, the IC shall notify the Chief of the Bureau of Fire Prevention of any violation or suspected violation of statutes or regulations that he or she became aware of during the course of the response to the hazardous material incident or during the post incident review process.

8.3 Specific incident termination instructions will be listed in the incident checklist.

9. POST INCIDENT PROCEDURES

9.1 INCIDENT ANALYSIS

A. The Incident Commander's responsibility following each hazardous materials operations includes a review of actions taken. Corrective actions should be taken at the lowest possible level. Recommendations regarding procedures or the elements of the response plan should be forwarded through the chain of command with endorsements to the Chief of Department.

B. Prior to leaving the scene, the IC shall review the particulars of the incident to make a preliminary determination regarding compliance with fire prevention regulations and directives. Non-compliance should be addressed through violation orders, summonses, vacate orders etc.. If necessary, consult the Bureau of Fire Prevention for assistance.

Additionally, within ten (10) days from the completion of the post incident review, the IC shall notify the Chief of the Bureau of Fire Prevention of any violation or suspected violation of statutes or regulations that he or she became aware of during the course of the response to the hazardous material incident or during the post incident review process.

C. As a standard part of this Emergency Response Plan the Fire Department will review all hazardous materials incidents in order to:

1. Identify and correct any deficiencies in the response plan.

2. Identify trends, patterns, and deficiencies in procedures that need to be addressed in revised operations, safety, or training programs.

3. Develop a database to establish profiles for decisions re: tools & equipment, training, budgeting, operations, hazard prevention legislation etc.

4. Identify incidents where the Fire Department may seek cost recovery or that may qualify for reimbursement under EPA regulations.

5. Document efforts of proactive intervention to reduce losses.

D. The process begins with a preliminary review of the following incidents:

1. City wide 10-80 response record.
2. Exposure reports CD-73; CD-72 Medical reports indicating Hazmat exposure.
3. Any incident involving "Decon".
4. Level 2 and 3 incidents.

E. Consolidated reports and descriptions of these incidents will be reviewed on a monthly basis by:

1. Bureau of Operations
2. Division of Safety
3. Division of Training
4. OSHA Coordinator

F. Findings and recommendations, if any, from any individual review will be forwarded through the chain of command to the Chief of Department for consideration.

G. A formal critique may be ordered by the Chief of Department. The formal critique report is included in the appendix of this document.

9.2 CRITIQUE OUTLINE

When a formal critique is ordered, the IC for the particular incident shall prepare a narrative report addressed to the Chief of Department, containing at least the following information. Include copies of the incident log to reduce preparation time.

1. Identifying information including the date, box number, location.

2. Description of conditions found and actions taken by the first responding units.

3. Description of conditions found and actions taken by the first Chief Officer to arrive.

4. Describe hazard identification and site control measures taken and results.

5. Describe the personal protective equipment and special chemical protective equipment used by each group of responders at the incident. Describe decision made re: changes in these levels of protection.

7. A timeline describing the notification, change of command and arrival of special units, outside agencies etc..

8. Describe the ICS organizational structure developed. (Include positions staffed, Command post, sectors / groups, control zones, etc.).

8. A description of the key phases of the incident including sufficient detail to explain changes in incident activities or other significant events during the life of the incident. Include description of alternative plans considered, if any.

9. Description of decon procedures.

10. Description of problems encountered and lessons learned.

9.3 EMERGENCY RESPONSE PLAN REVIEW

A formal cyclical review process and a method of keeping this document current with existing laws and standards will be developed and implemented at the time this document is finalized and published.

The review process will be developed with the intent described in the Incident Analysis portion of this document.

10. APPENDIX

10.1 REFERENCES

The following list of materials will provide greater insight on the individual subject areas discussed in this document:

A. **OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION** 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response;
B. **ENVIRONMENTAL PROTECTION AGENCY - 40 CFR 300**
C. **SUPERFUND AMENDMENT AND REAUTHORIZATION ACT**
D. **N.Y.C. OFFICE OF THE MAYOR** Mayoral Directive 82-2 (revised 1986)
E. **OFFICE OF EMERGENCY MANAGEMENT** Memorandum of Understanding - Asbestos (12/5/89)

10.2 ABBREVIATIONS

CFR	-	Code of Federal Regulations
CP	-	Command Post
DEP	-	Department of Environmental Protection
DOT	-	Department of Transportation
ERG	-	Emergency Response Guidebook (DOT)
ERP	-	Emergency Response Plan
EMS	-	Emergency Medical Services
EPA	-	Environmental Protection Agency (Federal)
HAG	-	Hazard Action Guide
IC	-	Incident Commander
ICS	-	Incident Command System
NFPA	-	National Fire Protection Association
OEM	-	Office of Emergency Management (NYC)
ORM	-	Other Regulated Materials
OSHA	-	Occupational Safety and Health Administration
PPE	-	Personal Protective Equipment
SCBA	-	Self Contained Breathing Apparatus
SOC	-	Special Operations Command
SOP	-	Standard Operating Procedure

- END OF PART 5 -

GLOSSARY OF TERMS

Appendix A
Incident Command System
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A

AGENCY REPRESENTATIVE

Individual assigned to an incident from another agency who has been delegated full authority to make decisions on all matters affecting that agency's participation at the incident. Agency representatives report to the Incident Liaison Officer. (See also: LIAISON)

"ASSIGNED" RESOURCES

Manpower and/or equipment assigned and performing tasks at an incident.

ASSISTING AGENCY

An agency (Law enforcement, EMS, etc.) directly contributing suppression, rescue, support service resources and/or personnel to another agency. (See also: COOPERATING AGENCY; LIAISON)

"AVAILABLE" RESOURCES

Resources assigned to an incident and not committed to a work assignment, but ready for immediate deployment.

B

BRANCH

The organization level instituted by the IC or Operations Chief to maintain appropriate span of control over an excessive number of sectors/groups; when operations may be in several locations; diverse functions are being managed. A branch may be geographical or functional in nature.

Example: An Exposure 3 Branch, EMS Branch.

BRANCH COMMANDER

An ICS title for individuals responsible for command of a BRANCH. Radio designation is as assigned by the IC or Operations Chief. (In the previous example, "EXPOSURE 3" or "EMS COMMAND")

C

CHIEF

ICS title for individuals responsible for command of the functional Sections: Operations, Planning, Logistics and Finance. (See individual listings)

COMMAND

The function of directing, ordering and/or controlling resources by virtue of explicit legal, agency, or delegated authority; Radio designation for the Incident Commander.

COMMAND POST

An area from which the Incident Commander exercises command and control over the incident.

COMMAND POST COMPANY

Engine companies that assist in the operation of the lobby command post at a high-rise fire or emergency.

COMMAND STAFF

The command staff consists of Information, Safety, and Liaison Officers, who report directly to the Incident Commander. (See individual listings)

COMMUNICATIONS

A sub-function of the Planning Section. Provides a network for the interchange of information within the ICS and between the command post and the dispatcher.

COMMUNICATIONS COORDINATOR (COMCORD)

Battalion Chief who serves as a communications manager. Controls all communications and supervises or maintains its associated functions (Field Comm., Command Control Chart, Etc.)

COOPERATING AGENCY

An agency supplying assistance other than direct suppression, rescue, support, or service functions to the incident control effort (Red Cross, Utility company, etc.). (See also: ASSISTING AGENCY; LIAISON)

COORDINATION

The process of systematically analyzing a situation, developing relevant information, and informing appropriate **command** authority (for its decision) of viable alternatives
for selection of the most effective combination of available resources to meet specific objectives.

The coordination process (which can be either intra-or interagency) does not, in and of itself, involve command dispatch actions. However, personnel responsible for coordination **may** perform command or dispatch functions within limits as established by specific agency delegations, procedures, legal authority, etc. (See also: UNIFIED COMMAND)

COST

A sub-function within the Finance section responsible for tracking cost, analyzing cost data, making cost estimates and recording cost-savings measures. (See FINANCE)

D-E

DEMOBILIZATION

A sub-function within the Planning Section. Responsible for assuring orderly, safe, efficient demobilization of resources committed to the incident.

DOCUMENTATION

A sub-function with the Planning Section responsible for recording/protecting all documents relevant to incident.

F

FACILITIES

A sub-function within the Logistics Section providing for facilities required at the incident. The facilities may include rehabilitation areas, feeding areas, security and lighting for the command post etc..

FIELD COMMUNICATION UNIT

A mobile facility carrying various types of communications equipment. This tactical command unit may serve as a field command post. It comprises the major portion of the incident communications center. It provides Resource and Situation Status at major incidents. (See also: COMMUNICATIONS; RESOURCE & SITUATION STATUS)

FINANCE SECTION

Responsible for tracking all costs and evaluating the financial considerations of the incident. When staffed reports directly to the IC. (See COST; PROCUREMENT; TIME)

FLEET MAINTENANCE

A sub-function within the Logistics Section responsible for fueling/maintaining/repairing vehicles/equipment and the transportation of supplies. (See also: SUPPORT)

FOOD

A sub-function within the Logistics Section responsible for providing food/refreshments for personnel involved with incident. This is currently provided by the Third Alarm Association. (See also: SERVICES)

G

GENERAL STAFF

The group of incident command personnel comprised of the Incident Commander, Operations Chief, Planning Chief, Logistics Chief and Finance Chief. (See also: INCIDENT COMMAND SYSTEM)

GROUP

An organizational level responsible for a specified **functional** assignment commanded by a group supervisor. Examples include: Ventilation group; Search group; Decon group. (See also: SECTOR)

GROUP SUPERVISOR

Individual responsible for managing a functional group. Radio designation is derived from assigned function. For example, "SEARCH GROUP 1".

H-I

INCIDENT

An occurrence or event, caused by human or natural phenomena. It requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

INCIDENT ACTION PLAN

The strategic goals, tactical objectives and support requirements for the incident. It is an ordered sequence of events, occurring within a designated period of time, that results in the accomplishment of specific objectives.

INCIDENT COMMANDER (IC)

The individual responsible for the management of all incident operations. The radio designation for the IC is **"COMMAND".**

INCIDENT COMMAND SYSTEM (ICS)

An emergency operations management structure which provides for unity of command and the efficient use of resources for the effective accomplishment of stated objectives pertaining to an incident. It includes the combination of facilities equipment, personnel and communications operating within a common organizational structure.

INFORMATION AREA

A functional area from which factual and timely reports are disseminated to the news media or other agencies.

INFORMATION OFFICER

The individual assigned responsibility for gathering and disseminating factual and timely reports to the media and other agencies. The release of information must be approved by the IC. The Information Officer is a member of the Command Staff. Radio designation is "INFORMATION". (See: COMMAND STAFF)

J-L

LIAISON OFFICER

The point of contact for assisting and cooperating agencies (local, State, Federal, or private sector) as needed or as directed by the Incident Commander. The Liaison Officer is a member of the Command Staff and has authority to commit resources to incident activities. Reports directly to IC. Radio designation is "LIAISON". (See: COMMAND STAFF)

LOGISTICS SECTION

Responsible for the procurement, distribution, maintenance and replacement of services, materials and personnel to support the incident. Managed by the Logistics Section Chief. Radio designation is "LOGISTICS". (See also: SERVICES; SUPPORT)

M

MEDICAL OFFICER

The Fire Department Medical Officer directed by the Incident Commander to respond to the incident and provide medical care for fire personnel. Radio designation is "MEDICAL OFFICER".

MUTUAL AID

Documents between the City of New York and surrounding communities in which the parties agree to assist one another upon request by furnishing personnel and equipment in an emergency situation.

N-O

OFFICER

ICS title for the Command Staff positions of Safety, Liaison, and Information. Also used when a individual supervises a sub-function within Planning, Logistics, or Finance.

ON-SCENE COORDINATOR (HAZ-MAT)

The highest ranking Police Dept. official at the incident. Responsible for coordinating responding agencies.

OPERATIONS SECTION

Staffed by the IC to carry out all the tactical decisions of the Incident Commander. May include as many as 5 Branches, 25 Sectors or Groups, and 125 Single Resources, or teams. Managed by the OPERATIONS CHIEF.

OPERATIONS SECTION CHIEF

Responsible for all tactical operations at the incident. Radio designation is "OPERATIONS".

"OUT-OF-SERVICE" RESOURCES

Resources assigned to an incident but unable to respond for mechanical, rest, or personnel reasons.

P

PLANNING SECTION

Collects, evaluates, and disseminates information regarding the incident. Supervises the development of the incident action plan. Sub-functions include resource and situation status, documentation, demobilization, technical specialists and communications. Managed by the Planning Section Chief. Radio designation is "PLANNING".

PLANNING MEETING

A meeting, held as needed throughout the duration of an incident, to select specific strategies and tactics for incident control operation and for service and support planning.

POLICE OPERATIONS COMMANDER

Responsible to the Incident Commander for the management of police related functions.

POST INCIDENT ANALYSIS

A review and discussion of actual operations and support performed in a recent incident, for the purpose of (1) identifying areas of strength and weakness and (2) developing corrective measures. It is conducted by key persons involved in the incident.

PROCUREMENT

A sub-function within the Finance Section responsible for financial matters involving vendors.

Q-R

RESOURCES

All personnel and major items of equipment available, or potentially available, for assignment to incident tasks on which status is maintained.

RESOURCE & SITUATION STATUS

A sub-function within the Planning Section. Responsible for recording the status of resources committed to incident and evaluation of: resources currently committed to incident; the impact that additional responding resources will have on incident; anticipated resource needs and analysis of the situation as it progresses.

RECUPERATION AND CARE AREA

Area designated for personnel to rest or for protection from the elements.

S

SAFETY OFFICER

Responsible for monitoring and assessing safety hazards or unsafe situations and developing measures for ensuring personnel safety. Member of the Command Staff. Radio designation is "SAFETY".

SECTION

That organization level having functional responsibility for primary segments of incident operations, such as: Operations, Planning, Logistics, and Finance. The Section level is established by the IC and supervises or manages various sub-functions. (See individual titles)

SECTOR

Organizational level having responsibility for Incident Operations in a specified **geographical** area, commanded by a sector supervisor.

SECTOR SUPERVISOR

The individual responsible for operations within a defined sector (geographical area). Radio designation is derived from assigned area. For example, "EXPOSURE 2".

SERVICES (LOGISTICS)

The supplying of medical, food or facility needs to operating fire personnel. (See also: FOOD; MEDICAL; FACILITIES)

SINGLE RESOURCE

An individual, company, or specialized unit. Radio designation is by unit name unless assigned to an specific ICS function or designation by the IC. (See also: UNIT)

SPAN OF CONTROL

The supervisory ratio, usually limited to three to seven subordinates, delineating the management limits of a supervisor.

STAGING AREA

Location where incident personnel and equipment are assembled prior to assignment at an incident. It should provide good access to the scene. It is supervised by a Staging Area Manager.

STAGING AREA MANAGER

The individual, designated by the Incident Commander, responsible for the assembling of personnel and equipment in the staging area. Reports to the IC until Operations Section is staffed. Radio designation is "STAGING".

STRATEGIC GOALS

The overall plan that will be used to control the incident. Strategic goals are broad in nature and are achieved by the completion of tactical objectives.

SUPPORT (LOGISTICS)

A sub-function within the Logistics Section providing the personnel, equipment, and supplies to support incident operations. This includes Mask Service, Fleet Maintenance, and any other specialized supply/support units. (See also individual titles)

T

TACTICAL OBJECTIVES

The operations that must be performed in order to satisfy the strategic goals. This is how the job should be done and they must be both specific and measurable.

TEAM

Any combination of single resources (units) or individuals put together for a temporary assignment under the direction of an officer. The number of individuals or single resources should not exceed five. Radio designation is as per related function or activity. For example "ROOF"(team) or "EXPOSURE 2"(team).

TECHNICAL SPECIALISTS

Personnel with special skills who are activated only when needed for a particular incident. These may include environmental or hazardous material experts, building engineers, Special Operations officers etc.. May work with the Planning Section or anywhere within the ICS Organization as directed.

TIME

A sub-function within the Finance Section. Responsible for record keeping of time for personnel working at incident. (See also: FINANCE)

U-Z

UNIT

An organization element having responsibility for a specific function as designated by the Department (an Engine Co.; Field communications etc.) or Incident specific activity or function as designated by the IC (Documentation; Food, etc.).

UNIFIED COMMAND

Shared responsibility for overall scene management as a result of a multi-agency or multi-jurisdiction incident. Goals, tactical objectives, tactical operations and use of resources are decided jointly. Implementation of the joint action plan is the responsibility the OPERATIONS CHIEF who usually is the representative of the agency having the greatest jurisdictional involvement.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix B
POLICE/FIRE PROTOCOL

DCN: 3.01.03 **A.U.C. 276**
April 5, 1994

POLICE/FIRE PROTOCOL

Appendix B
AUC #276 Police/Fire Protocol
Reproduced with permission of The Fire Department of the City of New York

1. INTRODUCTION

A protocol has been established to put an end to the confusion concerning the roles and responsibilities of the Police and Fire Departments at emergencies.

This protocol was developed in an atmosphere of cooperation and mutual respect between our two departments and with the interest of the public as a top priority.

The Fire Commissioner expects the cooperation of all officers and members to insure the successful implementation of this protocol.

2. GENERAL OPERATIONAL GUIDELINES

2.1 NOTIFICATIONS: Under the new protocol, both agencies will be responsible for immediately notifying the 911 communications system of any life-threatening situation which has come to their attention. The 911 system will, in turn, be responsible for notifying the appropriate response agencies. Implementation of the protocol will be monitored and evaluated by the Mayor's Office of Operations.

2.2 At the scene of a fire, the ranking Fire Department officer will assume command. The ranking member of the Police Department will report to the fire officer in charge and offer any assistance that may be required. The police supervisor will request the Fire Department commander to inform Fire Department subordinates that evidence, especially in suspected arson or explosive cases, MUST be preserved and safeguarded.

2.3 The ranking Police Department officer will assume command at the scene of a non-fire emergency. The ranking Fire Department official will report to the police commander and offer any assistance that may be required. The police and fire officers in command will make a joint examination to determine if the potential for a fire exists. In any case, the police commander will consider the recommendations of the fire officer in charge concerning actions to be taken to prevent a fire.

2.4 At the scene of any emergency, the police and fire officials in charge of their department resources will determine the special equipment carried by police and fire department units on the scene. The most effective and efficient tools required to effect a rescue will be used regardless of whether the tool belongs to the Police Department or the Fire Department. Furthermore, when conducting a joint operation, the special talents and abilities of members of both departments will be considered when making assignments and the first responding unit will commence rescue operations without delay.

2.5 During a joint operation, specific directions to members of both departments will be issued through their department's chain of command. Ranking police and fire commanders will confer frequently concerning orders and directions to be issued. The ranking officers of the Police and Fire Departments MUST be aware of the need for mutual cooperation. All police personnel and fire personnel MUST understand that they will be held strictly accountable for their conduct during joint operations.

3. SPECIFIC OPERATIONAL GUIDELINES

3.1 WATER RESCUES: The Fire Department and the Police Department will dispatch qualified divers to the scene of water rescues and upon arrival, will immediately commence rescue operations under the direction of the ranking police officer. The Police and Fire Department Scuba Units will undertake joint training exercises at least twice annually so that their rescue activities are well coordinated.

3.2 BOMB THREATS: Upon locating the explosive device, the NYPD Emergency Services Unit will request the bomb squad to respond to the scene. A Fire Department unit will respond to a nearby mobilization point designated by the ESU officer and await further instructions. The ranking police officer at the scene will remain the coordinator of on site operations.

3.3 HAZARDOUS MATERIALS: Both the Fire and Police Departments will respond to the scene of all hazardous materials incidents. The containment and mitigation of such materials will be done under the direction of the ranking fire officer.

3.4 STRUCTURAL COLLAPSES: Both the Police and Fire Departments will continue to respond to structural collapses. Rescue operations utilizing fire and police personnel will be under the ranking fire officer at the scene. All other on site activities will be coordinated by the ranking police officer. The departments will conduct joint structural collapse training exercises at least twice a year.

3.5 VEHICLE ACCIDENT EXTRICATION: The first extrication equipped unit to arrive on the scene, Police or Fire, will initiate rescue operations, and continue until they have finished, or until they request and receive relief. When both Police and Fire Units are on the scene, command of the overall operation will be under the ranking Police supervisor at the scene.

3.6 UTILITY EMERGENCIES: The Fire Department will assume primary responsibility for mitigating gas leaks, water leaks, fallen electrical or telephone lines, flooding conditions, fallen trees which are blocking roadways or unstable building facades. Police officers will respond to the scene only if requested by the Fire Department.

4. CONCLUSION

Both agencies are committed to insure the most effective response to life or death emergencies. This protocol is an important step towards achieving our objective.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix C
AGREEMENTS BETWEEN
THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY AND
THE FIRE DEPARTMENT OF THE CITY OF NEW YORK

Reproduced with permission of The Port Authority of New York and New Jersey.

WTCI - 113 - P

THE PORT AUTHORITY OF NY & NJ

One World Trade Center
New York, New York 10048

Law Department

Jeffrey S. Green
General Counsel

Lawrence S. Hofrichter, Chief
Finance Division
(212) 435-6220
(201) 961-6600 x6220

November 5, 1993

THE PORT AUTHORITY OF N.Y. & N.J.
TENANT CONSTRUCTION REVIEW UNIT
RECEIVED
NOV 09 1993
NOTED
REFERRED TO

Charles G. Sturcken, Deputy General Counsel
The New York City
Department of Buildings - Executive Offices
60 Hudson Street
14th Floor
New York, New York

Dear Mr. Sturcken:

Enclosed please find a fully executed original of the Memorandum of Understanding between the Port Authority and the New York City Department of Buildings.

For your information, the gubernatorial review period for the enclosed agreement will end at midnight Wednesday, November 17, 1993. It has been a pleasure working with you on this matter.

Very truly yours,

Walter M. Frank
Deputy Chief, Finance Division
Law Department

Enclosures

cc: William H. Goldstein, Deputy Executive Director, Capital Programs

bcc: J.S. Green, P.S. Cooper (51N), A.A. DiNome (68S), E.J. Fasullo (72S), L.S. Hofrichter, F.J. Lombardi (72S), C.J. Maikish (35E), A.J. Raiola, S.T. Van de Walle

WTCI-113-P

MEMORANDUM OF UNDERSTANDING BETWEEN THE NEW YORK CITY DEPARTMENT OF BUILDINGS AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

This Memorandum shall govern the relationship between the New York City Department of Buildings (the "Department") and the Port Authority of New York and New Jersey (the "Port Authority"), both parties entering into this agreement with the intention to establish procedures to be followed by the Port Authority for any building construction project ("Project"), to be undertaken by the Port Authority or any of its tenants at buildings owned or operated by the Port Authority and located in the City of New York (the "City), to assure conformance of Projects at such buildings with the standards set forth in the New York City Building Code (the "Code").

While the facilities of the Port Authority, an agency of the States of New York and New Jersey, are not technically subject to the requirements of local building codes, the long-standing policy of the Port Authority has been to assure that its facilities meet and, where appropriate, exceed Code requirements.

The purpose of this Memorandum is not only to restate that long-standing policy as part of an understanding with the City but to provide specific commitments to the Department, as the agency of the City responsible for assuring compliance with the Code, regarding procedures to be undertaken by the Port Authority for any Project at its facilities in the City to assure that the buildings owned or operated by the Port Authority within the City are in conformance with the Building Standards contained in the Code.

Accordingly, the Department and the Port Authority hereby agree as follows:

1. Port Authority Review. To assure conformance with the building standards set forth in the Code at the time of the design and construction of any Project, the Port Authority shall, in the case of each Project, thoroughly review and examine all plans in connection with such Project for conformance with the building standards set forth in the Code. Plans prepared for Projects to be undertaken by Port Authority tenants shall be prepared and sealed by a New York State licensed professional engineer or architect retained or employed by tenant; plans prepared for Projects to be undertaken by the Port Authority shall be prepared by a New York State licensed professional engineer or architect employed or retained by the Port Authority. The Port Authority's examination of plans shall be conducted by New York State licensed architects and engineers retained or employed by the Port Authority. The Port Authority engineer or architect approving the plans for any Project from the standpoint of Code conformance shall be a New York State licensed architect or engineer who shall not have assisted in the actual preparation of such plans.

2. Project File. The Port Authority shall maintain a file (the "Project File") for each Project which file shall at all times contain the most recently

prepared drawings, plans and any other documents required in connection with the review of the Project from the standpoint of Code conformance. In the case of any Project being effectuated by a tenant of the Port Authority (a "Tenant Project") such file shall also include the Tenant Alteration Application prepared by the Tenant. In the case of any project administered by a line department of the Port Authority, such file shall include any construction application prepared in connection with such Project. The Line Departments of the Port Authority are currently its World Trade, Aviation, Interstate Transportation, Port, and Regional Development Departments.

3. Project Certification. For each Tenant Project, the Port Authority shall require the Tenant to obtain the certification of a New York State licensed architect or engineer that such Project was constructed in accordance with the approved plans and specifications for such Project. For any Project effectuated by the Port Authority, the Chief Engineer or his successor in duties shall certify that the Project was constructed in accordance with the approved plans and specifications for the Project. Certifications for each Project shall be maintained in the Project File.

4. Copies of Project File. The Department may at any time request the Port Authority to provide it with a copy of any Project File and the Port Authority shall promptly provide a copy of the Project File to it.

5. Variances. The Port Authority shall promptly advise the Department of any Project approved by the Chief Engineer of the Port Authority which involves, in the judgment of the Chief Engineer of the Port Authority or his successor in duties, a variance from the clear requirements of the Code. In the event that the Department disagrees with the manner in which questions of Code conformance have been or are proposed to be dealt with in connection with such Project, it may so advise the Authority. The Port Authority shall seek expeditiously to resolve the matter. Any matter of Code conformance in connection with such Project which the Department believes involves an unacceptable variance from the requirements of the Code shall be subject to the further review of the Port Authority Board of Commissioners. The Commissioners shall be advised of the Department's views on the matter.

6. Inspections and Surveys. The Port Authority shall continue to conduct or cause to be conducted all building inspections, during both construction and post-construction periods, required under the Code. In addition, the Port Authority will continue to perform structural integrity inspections on a cyclical basis for all of its structures located in the City.

7. Port Authority Responsibility. As indicated above, the purpose of this Agreement is to set forth certain basic understandings between the Department and the Port Authority. It is understood, however, that the Port Authority with its tenants shall continue to bear the responsibility for life safety in buildings at its facilities and nothing in this Agreement is intended to impose any obligations of inspection or review on the Department. The Department shall refer back to the Chief Engineer of the Port Authority any requests for

information or interpretation which it may receive from tenants of the Port Authority with respect to any Project.

8. No Personal Liability. No Commissioner, officer, agent or employee of the Port Authority or the Department shall be held personally liable under any provision of this Agreement or because of its execution or attempted execution or because of any breach or alleged breach thereof.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed, sealed and attested.

ATTEST:

Secretary

DATE: 11/3/93

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By: Stanley Brezenoff
Executive Director

ATTEST:

FRANK M. SCHWARTZ
Notary Public, State of New York
No. 41-4632566
Qualified in Queens County
Commission Expires January 31, 1995

DATE: 10/28/93

THE NEW YORK CITY DEPARTMENT BUILDINGS

By: Stewart D. O'Brien
Acting Commissioner

WTCI-113-P

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
Commercial Litigation Division (68E)

Memorandum

OCT 18 A11 : 02

Chief Executive's Office
Received: ____ Date Out: 10/18
To: ☑ D. Mont[illegible] ☑ F. Lombardi
☑ J. Sp[illegible] ☐ P. Keough
Action:
☐ Please handle
☐ Prepare response ____ signature
☐ Review and ____ me
☑ For your [illegible]
☐ Other
Comments: ____

TO: Lysa Meduri, Acting Secretary
FROM: Walter M. Frank
DATE: October 16, 1995
SUBJECT: **Transmittal of Letter Agreement - NYC Department of Buildings**

Copy to: J. Green, N. Chanfrau, P. Cooper, W. Goldstein, H. Henschel, F. Lombardi

Transmitted for the official records of the Port Authority is a Letter Agreement between the Port Authority and the New York City Department of Buildings providing for a change to the recent Supplement to the Basic Memorandum of Understanding between the Department and the Port Authority in connection with the Port Authority's Tenant Self-Certification Program at the World Trade Center.

Walter M. Frank
Deputy Chief
Commercial Litigation Division

WMF:gk

Encl.

MEMORANDUM OF UNDERSTANDING BETWEEN THE NEW YORK CITY DEPARTMENT OF BUILDINGS AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

This Memorandum shall govern the relationship between the New York City Department of Buildings (the "Department") and the Port Authority of New York and New Jersey (the "Port Authority"), both parties entering into this agreement with the intention to establish procedures to be followed by the Port Authority for any building construction project ("Project"), to be undertaken by the Port Authority or any of its tenants at buildings owned or operated by the Port Authority and located in the City of New York (the "City), to assure conformance of Projects at such buildings with the standards set forth in the New York City Building Code (the "Code").

While the facilities of the Port Authority, an agency of the States of New York and New Jersey, are not technically subject to the requirements of local building codes, the long-standing policy of the Port Authority has been to assure that its facilities meet and, where appropriate, exceed Code requirements.

Accordingly, the Department and the Port Authority hereby agree as follows:

1. Port Authority Review. To assure conformance with the building standards set forth in the Code at the time of the design and construction of any Project, the Port Authority shall, in the case of each Project, thoroughly review and examine all plans in connection with such Project for conformance with the building standards set forth in the Code. Plans prepared for Projects to be undertaken by Port Authority tenants shall be prepared and sealed by a New York State licensed professional engineer or architect retained or employed by tenant; plans prepared for Projects to be undertaken by the Port Authority shall be prepared by a New York State licensed professional engineer or architect employed or retained by the Port Authority. The Port Authority's examination of plans shall be conducted by New York State licensed architects and engineers retained or employed by the Port Authority. The Port Authority engineer or architect approving the plans for any Project

[redacted]

2. Project File. The Port Authority shall maintain a file (the "Project File") for each Project which file shall at all times contain the most recently

prepared drawings, plans and any other documents required in connection

[redacted]

3. Project Certification. For each Tenant Project, the Port Authority shall require the Tenant to obtain the certification of a New York State licensed architect or engineer that such Project was constructed in accordance with the approved plans and specifications for such Project. For any Project effectuated by the Port Authority, the Chief Engineer or his successor in duties

[redacted]

4. Copies of Project File. The Department may at any time request the Port Authority to provide it with a copy of any Project File and the Port Authority shall promptly provide a copy of the Project File to it.

5. Variances. The Port Authority shall promptly advise the Department of any Project approved by the Chief Engineer of the Port Authority which involves, in the judgment of the Chief Engineer of the Port Authority or his successor in duties, a variance from the clear requirements of the Code. In the event that the Department disagrees with the manner in which questions of Code conformance have been or are proposed to be dealt with in connection with such Project, it may so advise the Authority. The Port Authority shall seek expeditiously to resolve the matter. Any matter of Code conformance in connection with such Project which the Department believes involves an unacceptable variance from the requirements of the Code shall be subject to the further review of the Port Authority Board of Commissioners. The Commissioners shall be advised of the Department's views on the matter.

6. Inspections and Surveys. The Port Authority shall continue to conduct or cause to be conducted all building inspections, during both construction and post-construction periods, required under the Code. In

[redacted]

7. Port Authority Responsibility. As indicated above, the purpose of this Agreement is to set forth certain basic understandings between the Department and the Port Authority. It is understood, however, that the Port Authority with its tenants shall continue to bear the responsibility for life safety in buildings at its facilities and nothing in this Agreement is intended to impose any obligations of inspection or review on the Department. The Department shall refer back to the Chief Engineer of the Port Authority any requests for

information or interpretation which it may receive from tenants of the Port Authority with respect to any Project.

8. No Personal Liability. No Commissioner, officer, agent or employee of the Port Authority or the Department shall be held personally liable under any provision of this Agreement or because of its execution or attempted execution or because of any breach or alleged breach there

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed, sealed and attested.

ATTEST:

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By: _____

DATE: 11/3/93

ATTEST:

FRANK M. SCHWA
Notary Public, State of N
No. 41-4632586
Qualified in Queens C
Commission Expires Januar

3/93 DATE: 10/2

By: _____
Stewart D. O'Brien
Acting Commissioner

Frank M Schwartz

WTCI-114-P

MEMORANDUM OF UNDERSTANDING BETWEEN THE FIRE DEPARTMENT OF THE CITY OF NEW YORK AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

EXECUTED AS OF [redacted]

On April 15, 1993, the Port Authority, in order to maintain and enhance the safety of Port Authority facilities, adopted a policy providing for the [redacted] fire safety inspection of a Port Authority facility and for implementation of fire safety systems to be [redacted] departments and fire safety agencies.

The purpose of this Memorandum of Understanding is to reiterate the Port Authority's commitment to this policy and to set forth certain procedures to facilitate the implementation of this policy for buildings at Port Authority facilities located in New York City.

Specifically, the Fire Department of the City of New York ("FDNY") and the Port Authority hereby agree as follows:

1. FDNY, acting through its Bureau of Fire Prevention ("BFP"), shall have the right to conduct fire safety inspections at any Port Authority facility in the City of New York. These inspections will generally be located in the Port Authority's General Manager of Risk Management operations, but the BFP, at its option, may conduct inspections without prior notice to the Port Authority.

2. BFP will issue a letterhead report of its fire safety findings and recommendations for corrective action with respect to any deficiencies found to the Port Authority's General Manager of Risk Management. The Port Authority will promptly undertake the implementation of such findings addressed in the BFP report forming a part of such findings (including undertaking corrective action with respect to any deficiencies) and shall notify BFP of its actions. BFP may at any time conduct [redacted]

3. Prior to the introduction of a new fire safety system or the introduction of modifications to an existing fire safety system at any building located at a Port Authority facility in the City of New York, the Port Authority shall provide BFP with copies of the drawings and specifications or other appropriate description of such system or modification for review and approval. The Port Authority policy is and will continue to be to assure that such new or modified fire safety systems are in compliance with local codes and regulations. When circumstances or conditions are unusual, the Port Authority shall have the right to petition the Bureau of Fire Prevention for a variance in specific cases.

4. The Port Authority and BFP will seek to expeditiously resolve any issues arising out of matters covered by this Memorandum of Understanding.

5. Nothing in this Memorandum of Understanding is intended to limit or modify in any way any arrangements which the Port Authority currently has with local fire companies in New York City regarding either facility inspections or joint training exercises or any other matters.

6. The Port Authority shall continue to be exempt from all inspection and permit fees for FDNY inspections at its facilities.

7. No Commissioner, officer, agent or employee of the Port Authority or FDNY shall be held personally liable under any provision of this Memorandum or because of its execution or attempted execution or because of any breach or alleged breach thereof.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed and sealed by duly authorized officers thereof.

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Stanley Brezenoff
Executive Director

FIRE DEPARTMENT - CITY OF NEW YORK

William M. Feehan
Fire Commissioner
City of New York

MEMORANDUM OF UNDERSTANDING BETWEEN THE FIRE DEPARTMENT OF THE CITY OF NEW YORK AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

On April 15, 1993, the Port Authority, in order to maintain and enhance the safety of Port Authority facilities, adopted a policy providing for the implementation of fire safety recommendations made by local government fire departments after a fire safety inspection of a Port Authority facility and for the prior review by local fire safety agencies of fire safety systems to be introduced or added to a facility.

The purpose of this Memorandum of Understanding is to reiterate the Port Authority's commitment to this policy and to set forth certain procedures to facilitate the implementation of this policy for buildings at Port Authority facilities located in New York City.

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3. Prior to the introduction of a new fire safety system or the introduction of modifications to an existing fire safety system at any building located at a Port Authority facility in the City of New York, the Port Authority shall provide BFP with copies of the drawings and specifications or other appropriate description of such system or modification for review and approval. The Port Authority policy is and will continue to be to assure that such new or modified fire safety systems are in compliance with local codes and regulations. When circumstances or conditions are unusual, the Port Authority shall have the right to petition the Bureau of Fire Prevention for a variance in specific cases.

4. The Port Authority and FDR will seek to expeditiously resolve any issues [redacted]

5. Nothing in this Memorandum of Understanding is intended to limit or modify [redacted]

6. The Port Authority shall continue to be exempt from all inspection and permit fees for FDNY inspections at its facilities.

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IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed and sealed by duly authorized officers thereof.

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By: Stanley Brezenoff
Stanley Brezenoff
Executive Director

FIRE DEPARTMENT - CITY OF NEW YORK

By: William H. Feehan
William H. Feehan
Fire Commissioner
City of New York

MEMORANDUM OF UNDERSTANDING BETWEEN THE NEW YORK CITY DEPARTMENT OF BUILDINGS AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

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5. Variances. The Port Authority shall promptly advise the Department of any Project approved by the Chief Engineer of the Port Authority which involves, in the judgment of the Chief Engineer of the Port Authority or his successor in duties, a variance from the clear requirements of the Code. In the event that the Department disagrees with the manner in which questions of Code conformance have been or are proposed to be dealt with in connection with such Project, it may so advise the Authority. The Port Authority shall seek expeditiously to resolve the matter. Any matter of Code conformance in connection with such Project which the Department believes involves an unacceptable variance from the requirements of the Code shall be subject to the further review of the Port Authority Board of Commissioners. The Commissioners shall be advised of the Department's views on the matter.

6. Inspections and Surveys. The Port Authority shall continue to conduct or cause to be conducted all building inspections, during both construction and post-construction periods, required under the Code. In addition, the Port Authority will continue to perform structural integrity inspections on a cyclical basis for all of its structures located in the City.

7. Port Authority Responsibility. As indicated above, the purpose of this Agreement is to set forth certain basic understandings between the Department and the Port Authority. It is understood, however, that the Port Authority with its tenants shall continue to bear the responsibility for life safety in buildings at its facilities and nothing in this Agreement is intended to impose any obligations of inspection or review on the Department. The Department shall refer back to the Chief Engineer of the Port Authority any requests for

information or interpretation which it may receive from tenants of the Port Authority with respect to any Project.

8. No Personal Liability. No Commissioner, officer, agent or employee of the Port Authority or the Department shall be held personally liable under any provision of this Agreement or because of its execution or attempted execution or because of any breach or alleged breach thereof.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be signed, sealed and attested.

ATTEST:

Secretary

DATE: 11/3/93

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By: _____
Stanley Brezenoff
Executive Director

ATTEST:

FRANK M. SCHWARTZ
Notary Public, State of New York
No. 41-4632586
Qualified in Queens County
Commission Expires January 31, 19 95

DATE: 10/28/93

THE NEW YORK CITY DEPARTMENT BUILDINGS

By: _____
Stewart D. O'Brien
Acting Commissioner

1

SUPPLEMENT
6-7-95
WTC SELF-CERTIFICATION

SUPPLEMENT TO MEMORANDUM OF UNDERSTANDING BETWEEN THE NEW YORK CITY DEPARTMENT OF BUILDINGS AND THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

In November, 1993 the New York City Department of Buildings (the "Department") and the Port Authority of New York and New Jersey (the "Port Authority") entered into the attached Memorandum of Understanding (the "Memorandum") establishing certain procedures for the purpose of helping to assure conformance of construction projects to be undertaken at buildings owned or operated by the Port Authority in New York City with the standards set forth in the New York City Building Code.

Recently, the Department implemented its own optional plan review system providing for professional certifications of applications and plans and subsequent construction work falling under its jurisdiction.

The purpose of this Supplement to the Memorandum is to provide under the Memorandum for the adoption by the Port Authority of a procedure under which any Port Authority tenants at the World Trade Center may utilize New York State licensed architects or engineers to certify, in lieu of any review by the Port Authority, that (i) the tenant's construction plans are in conformance with the standards set forth in the New York City Building Code, and (ii) construction has been performed in accordance with such plans, it being understood that the persons making the certifications described in (i) and (ii) shall not be the same.

Accordingly, the Department and the Port Authority hereby agree that the Memorandum is amended as follows:

1. Professional Certification. Notwithstanding anything to the contrary in the Memorandum, the Port Authority may, in lieu of any reviews or certifications by the Port Authority provided for in the Memorandum, provide procedures pursuant to which its tenants at the World Trade Center may utilize New York State licensed architects or engineers meeting qualifications to be established by the Port Authority to (A) prepare and review such tenant's plans for the construction of any project and certify that such plans conform with the building standards set forth in the New York City Building Code and (B) certify that such project has been constructed in accordance with the approved plans and specifications for such project. The person or firm performing the review and certification described in (A) above shall not be the same person or firm providing the certification described in (B) above.

2. Other Provisions. Except as provided herein, all the terms and conditions of the Memorandum shall remain in full force and effect.

3. No Personal Liability. No Commissioner, officer, agent or employee of the Port Authority or the Department shall be held personally

liable under any provision of this Supplement or because of its execution or attempted execution or because of any breach or alleged breach thereof.

IN WITNESS WHEREOF, the parties hereto have caused instrument to be signed, sealed and attested.

ATTEST:

SECRETARY

DATE: 6/7/95

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By:

WITNESS:

FRANK M. SCHWARTZ
Notary Public, State of New York
No. 41-4632586
Qualified in Queens County
Commission Expires Jan. 31, 1997

THE NEW YORK CITY DEPARTMENT BUILDINGS

By:
Commissioner

DATE: 6/1/95

+ 9-15-95 SUPPLEMENT REVISION

THE PORT AUTHORITY OF NY & NJ

One World Trade Center
New York, N.Y. 10048

William H. Goldstein
Deputy Executive Director/
Capital Programs
(212) 435-8415
(201) 961-6000 x8415

September 15, 1995

Honorable Joel A. Miele, Sr., Commissioner
Department of Buildings
City of New York
60 Hudson Street
New York, New York 10013

Dear Commissioner Miele:

As you know, the Port Authority of New York and New Jersey (the "Port Authority") and the New York City Department of Buildings (the "Department") recently executed a supplement (the "Supplement") to the Memorandum of Understanding between the Department and the Port Authority to provide that the Port Authority's tenant at the World Trade Center could, in lieu of any review by the Port Authority, use New York State licensed architects or engineers meeting qualifications to be established by the Port Authority to: (A) prepare and review such tenant's plans for the construction of any project and certify that such plans conform with the building standards set forth in the New York City Building Code and (B) certify that such project has been constructed in accordance with the approved plans and specifications for such project.

As you also know, the Supplement provides that the person or firm performing the review and certification described in (A) above shall not be the same person or firm providing the certification described in (B) above. A copy of the Supplement is attached.

This letter will confirm the agreement of the Port Authority and the Department that, notwithstanding the last sentence of paragraph 1 of the Supplement, a single licensed consultant may make both certifications described in (A) and (B) of such paragraph, except where the alteration would change the character of the occupancy group under paragraph 27-237 of the New York City Building Code which would have been applicable to such space had such space been located in a privately owned building.

If the foregoing meets with your approval, please be good enough to sign this letter on behalf of the Department where indicated below and return one of the originals to me. In light of the fact that three originals of the Supplement were furnished to the Department, we have, for your record purposes, executed in total four originals of this letter.

Very truly yours,

William H. Goldstein
Deputy Executive Director
Capital Programs

P1

On December 30, 1993, the Port Authority of New York and New Jersey (the "Port Authority") and the Fire Department of the City of New York ("FDNY") entered into a Memorandum of Understanding ("MOU") with respect to certain matters relating to the implementation of the policy adopted by the Port Authority on April 15, 1993 regarding the maintenance and enhancement of fire safety at Port Authority facilities.

Under paragraph 3 of the MOU, the FDNY, acting through its Bureau of Fire Prevention ("BFP") was to receive copies of the drawings and specifications of proposed new or modified fire safety systems for BFP's review and approval. FDNY has requested, and the Port Authority is agreeable, to the following changes to paragraph 3 of the MOU. Accordingly, effective January 1, 1995, FDNY and the Port Authority agree that paragraph 3 of the MOU shall be amended to read as follows:

3. The Port Authority shall notify the BFP in writing prior to the introduction of a new fire safety system or the introduction of modifications to an existing fire safety system at any building located at a Port Authority facility in the City of New York.

a. Port Authority Review: To assure conformance with the standards set forth in local codes and regulations at the time of the design and construction of any new or modified fire safety system, the Port Authority shall, in the case

[redacted]

c. Fire Safety System Certification: For each Tenant System, the Port Authority shall require the Tenant to obtain the certification of a New York State licensed architect or engineer that such system was constructed in accordance with the approved plans and specifications. For any system effectuated by the Port Authority, Risk Management shall certify that the system was constructed in accordance with the approved plans and specifications. Certifications for each System shall be maintained in the New and/or Modified Fire Safety System File.

d. Copies of New and/or Modified Fire Safety System File: The BFP may at any time request the Port Authority to provide it with a copy of any Fire Safety System File and the Port Authority shall promptly provide a copy of the File as requested. The BFP reserves the right to audit any new or modified fire safety system to assure conformance with the standards set forth in local codes and regulations.

e. Variance: The Port Authority policy is and will continue to be to

[redacted]

IN WITNESS WHEREOF, the Port Authority and FDNY have caused this First Amendment to the MOU to be signed by duly authorized officers thereof.

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Dated: 2/2/95

By: _____
Stanley Brezenoff,
Executive Director

Approved as to Form: WF

Approved as to Terms: SB

FIRE DEPARTMENT - CITY OF NEW YORK

Dated: 1/27/95

By: _____
Howard Safir
Fire Commissioner
City of New York

Appendix D
ELEVATOR OPERATIONS

DCN: 3.02.17

TRAINING BULLETIN
EMERGENCIES 1
March 15, 1997

ELEVATOR OPERATIONS

Appendix D
Training Bulletin Emergencies 1 Elevator Operations
Reproduced with permission of The Fire Department of the City of New York

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6. GAL Drop Key
7. GAL Vandal Resistant Key

1. INTRODUCTION

1.1 This bulletin will outline the following:

1.1.1 Operational procedures used at EMERGENCIES and INCIDENTS in which people are trapped in stuck elevators.

1.1.2 Guidelines for the utilization of elevators by this department during a fire situation.

1.1.3 Familiarization of members with elevator components and terminology which are essential in effective and safe operations.

1.2 The instructions and information presented here cannot be expected to cover all conditions that confront the department at elevator operations.

1.3 Members are advised that the training video "Elevator Emergencies" contains additional details.

2. ELEVATOR INCIDENTS AND EMERGENCIES - DEPARTMENT POLICY

2.1 The function of the Fire Department at elevator operations is limited to the safe removal of persons trapped in the elevator car or hoistway. Repairs to and reactivation of elevators are not carried out by members of this department.

2.2 Contact shall be made with responsible building management personnel for any information and assistance that will aid the operation. However the first units at the scene should start operations at once without awaiting arrival of the management personnel.

2.3 In the event there is evidence of injuries to trapped persons, the officer in command shall request the response of medical assistance.

2.4 Fire Department elevator operations are divided into two categories;
INCIDENTS and EMERGENCIES.

2.4.1 INCIDENT:

A stuck elevator with trapped passengers not in immediate danger and no evidence of injury.

Note: Conditions must be constantly monitored, an INCIDENT may escalate to an EMERGENCY.

2.4.2 EMERGENCY**:**

A situation where one or more of the following exist:

A. Fire endangering passengers in a stuck elevator.

B. Passenger of stuck elevator injured.

C. Passenger of stuck elevator in panic.

3. ELEVATOR INCIDENT AND EMERGENCY - PROCEDURES

3.1 Stuck Elevator Cars.

Problems arise from defective or non-functioning electrical or mechanical devices and equipment.

3.1.1 Electrical problems are the most frequent cause of elevator malfunction.

A. Common causes of electrical problems:

1. Car or hoistway door contacts open.

2. Blown fuses.

3. Shorting of electrical cables.

B. When an electrical problem occurs the following can be expected:

1. Elevator cars will be suspended on the hoistway cables.

2. Elevator brake will be applied in the hold position.

3.1.2 Mechanical problems though not as common, may also be encountered.

3.2 Size Up

3.2.1 Locate the car using the following.

A. Lobby control panel - check floor indicator.

B. If available use intercom or telephone system of the stuck car. Passengers may be able to give their approximate location.

C. Open the hoistway door at first floor with elevator key and look up shaft. Key devices are usually required at the lower levels and may be present at all levels.

1. If the hoistway door has a glass panel check the shaft before opening the door. Using a flash light, look for the governor ropes and the counterweight. Movement of either one of these is an indication that the car is in motion, do not open the hoistway door. The governor rope is generally located on either side near one of the far corners of the shaft.

D. The location of the counterweight can be used to approximate the position of the car. For example, in a 6 story building where the elevator serves the basement, if the counterweight is on the 1st floor, the stalled car would be at the 5th. The counterweight can be located by viewing through the wire glass door panel or by opening a hoistway door.

E. Enter a car in the same bank and open top hatch if no damage will be done to the elevator car.

F. Use the floor selector in the machinery room, it indicates the exact location of elevator car.

3.2.2 Methods of communicating with passengers:

A. Elevator car telephone.

B. Elevator car intercom.

C. Call or yell up hoistway, or speak through car and hoistway doors.

Note: If emergency bell is ringing instruct the car passengers to deactivate the alarm and emergency stop button. A ringing bell can cause anxiety, confusion and hamper communications.

3.2.3 Methods of passenger removal:

A. Primary Removal Procedures, section 3.3.

B. Secondary Removal Procedures, section 3.6.

C. Emergency Removal Procedures, section 3.7.

3.3 Primary Removal Procedures

Primary removal procedures are simple approaches performed without turning off the elevator power.

There are two types of primary removal procedures. The order in which they are tried is not important. Try all if necessary.

3.3.1 Checking Electrical Contacts.

The first type of primary removal procedures checks whether simple electrical contacts might have been broken. However if the passengers have activated the Emergency Stop Button, these methods will not work. The passengers must be instructed to deactivate the Emergency Stop Button.

A. Have a passenger press Door Open Button. If the car is level with the landing this may open both the car and hoistway door.

B. Press lobby call button.

C. Instruct passengers to insure the car door is fully closed. Have a person push the door towards the closed position.

D. Have members physically close all hoistway doors on the shaft. Air movement in shaft may have opened an interlock cutting power to the car. Check the hoistway doors in the vicinity of the stuck car first.

3.3.2 Firemen Service.

The second type of primary removal procedure is activating Firemen Service if available. Firemen Service will over ride the Emergency Stop Button.

A. Activate Firemen Service - Phase I. The stuck elevator may return to the main lobby or sky lobby and open its doors.

B. Firemen Service should be deactivated when the car responds by returning to the lobby or if it's clear that the car isn't responding.

3.4 Summon an elevator mechanic if Primary Removal Procedures fail.

3.4.1 Telephone number of the mechanic is required to be posted in the machinery room near the elevator power switch.

3.4.2 Consider the possibility of an elevator mechanic on duty in a nearby building.

3.4.3 Secondary Removal Procedures may be initiated prior to the arrival of the mechanic.

3.5 Precautions During Secondary and Emergency Removal Procedures.

3.5.1 Power Removal

Whenever Secondary or Emergency Removal Procedures are used, power removal is essential. Dispatch two members to the elevator machinery room to shut off the power to the stalled car. The machinery room may be located at the top of the shaft, at the bottom of the shaft or two levels above the highest floor serviced by the elevator.

A. Members should be equipped with a handie-talkie and forcible entry tools. Communication between members in machinery room and on landing is necessary.

B. Building maintenance personnel may be able to provide members with keys to the elevator machinery room.

C. Members assigned to the elevator machinery room will:

1. Determine which shaft the stalled car is in.

2. Shut off power to the stalled car when directed. Each elevator is controlled by its own power switch. Elevator power switch boxes and motors are required to be labeled in a manner which relates motor to switch. (Ex. Switch #1, Motor #1)

   a. If any doubt exist open as many elevator power switches as required to insure a safe operation. Allow passengers to exit a serviceable car before removing power.

3. Remain at the power switch throughout the operation to insure the power is not restored.

4. Upon completion of the operation DO NOT restore power to the stalled car.

Note: When operating in elevator machinery rooms, located above the shaft, members should avoid stepping on the cover or grating over the elevator shaft ventilation opening. The grating may be improperly seated or removed and replaced with cardboard or other flimsy material. A member stepping on an unsafe grating or covering could fall the entire height of the shaft. The ventilation opening is also known as the smoke hole.

3.5.2 Other Precautions.

Once you move beyond the Primary Removal procedures there are several precautions you should be aware of.

A. Members are not to enter the shaft or remove passengers from the car until assured power has been removed.

B. When passengers are removed from a car between floors they should be taken up and out of the car if practical. This eliminates the possibility of a passenger falling down the shaft after exiting the elevator. If they are removed to the lower landing, the shaft opening must be protected.

C. Members operating in the shaft are to be secured by a life saving rope.

D. Members shall not normally be permitted to enter the shaft below the elevator car. During a rescue necessitating members entering the shaft below the car, the power switch must be turned off.

E. The elevator shall never be jacked up or moved in an upward direction. This action may free the car safeties causing the car to move either upward or downward depending on the live load in the car.

F. No adjustment to or prying of the elevator machinery brake shall be attempted. The brake will be in a safe position and should not be tampered with.

G. In older elevator installations if the condition of the elevator brake is doubtful additional protection can be provided by placing a heavy timber, iron bar or tool between the spokes of the hoisting drum after power is removed. In most newer installations this procedure can be dangerous and impractical. Electrical components are usually in a close proximity to the drum and most drums are constructed in a manner which prevents getting an effective purchase.

H. If conditions indicate that the elevator is unstable additional precautions must be taken to prevent the movement of the car in either direction. Consider securing the car to structural members of the building using utility ropes, chains or shoring.

3.6 Secondary Removal Procedures

3.6.1 All efforts must be made to remove passengers via elevator car and hoistway door using an elevator tool or key or the procedures following in sections 3.6.3 & 3.6.4.

A. See addenda to this bulletin for a description of elevator keys and tools and instruction for their use.

3.6.2 Passengers of the stuck car can assist in their removal. Direct the passenger of the car to attempt to open the car door by physically exerting pressure toward the open position. If they succeed in opening the car door instruct them to lift the locking arm on sliding hoistway type doors, or to depress or lift the roller on hinge type hoistway doors.

3.6.3 If the elevator has a two speed system, commonly found in buildings over 10 stories, the following procedure may work:

A. If Emergency Stop Button has been activated have passengers deactivate it.

B. Have members in elevator machinery room shut power to the stuck car and turn it on again.

Note: This is the only circumstance in which the elevator power may be restored by members of this department. If this procedure fails, power must be shut off and members are not to restore power after completion of operations.

C. If the car is to restart it will do so within 10 seconds.

D. Communications must be maintained when attempting this procedure. Passengers and members must be prepared for the sudden movement of the car or car door.

3.6.4 If stuck car is in a multi car hoistway "POLING" can be used to remove the passengers:

A. Have member work from an adjacent car which is nearest the leading edge side of hoistway door of the stuck car.

B. Adjacent car should be positioned to give access to upper portion of the hoistway door to be opened.

C. Have one member remain on the landing at the hoistway door of the stuck car.

D. Member in the adjacent car inserts pole or hook between the striking post and the hoistway door and trips the lock by either depressing the roller or pushing on the locking arm.

1. Hinge type door - Depress the roller.

2. Sliding type door - push up on locking arm.

E. Member on the landing near hoistway door of the stuck car opens hoistway door when the lock is disengaged.

F. Elevator car door is then opened.

3.7 Emergency Removal Procedures

This section outlines procedures which may only be used during an EMERGENCY as defined in section 2.4.2, or when directly advised by an elevator mechanic. Primary and secondary procedures are usually quicker and more efficient than the methods outlined in this section. The decision of what method to use will be based on the size-up of the officer in command.

3.7.1 Power to the stuck elevator must be off when you use Emergency Removal Procedures. This should have been done before trying Secondary Removal Procedures.

3.7.2 An elevator car will have a top hatch or a side exit - sometimes both. One of these may provide a route by which you can remove trapped passengers.

A. Top Hatch Removal**.**
Although the law prohibits welding or bolting top hatches shut on elevators, it does happen and it can make this procedure very time consuming.

1. Open a hoistway door or access panel (required in single car blind hoistways) on floor above the stuck car.

2. Provide adequate lighting.

3. Lower a portable ladder to the elevator roof. Use straight ladder if possible. If an extension ladder is used tie the halyard around the rungs of both sections of the ladder. This will prevent the lower section from dropping on to the car roof.

4. Climb down to the car roof. Maximum of two firefighters are to be permitted on the roof of the car at one time.

5. All members working in the shaft are to be secured with a life saving rope.

6. Open the top hatch.

   a. This may require the use of a wrench or screw driver.

   b. Forcible entry tools may be required.

7. A small portable ladder is lowered into the elevator.

8. One member equipped with a handie talkie enters car. Member in the car must determine the order of removal. Secure each person with a life saving rope.

9. Members are to remain in physical contact with trapped persons while they are being removed.

B. Side Exit Removal.

Useful under conditions of partial power loss in multi car hoistways. It may not be useful where a structural beam blocks a side exit or the rescue car can't be brought level with the stuck car.

1. Members must work from a car that is in the same bank and is adjacent to the stuck car. This will become the rescue car.

2. Bring rescue car even with stuck elevator.

   a. If mechanic is present, use his operating key to bring the car level with stuck car.

3. Remove power to rescue car. Power to the stuck car was previously removed.

4. Open side exit in rescue car.

   a. A key or forcible entry is required to open panel from inside the car.

5. Open side exit of stuck car. It is openable by hand from the shaft side.

6. Planks of sufficient lengths (6' or longer) should be used as a bridge between cars.

7. Member equipped with a handie talkie and secured with life saving rope crosses planks to the stuck car.

8. Member determines the order of removal. Secure each passenger with a life saving rope and assist them to the rescue car.

9. After passengers are removed restore power to the rescue car.

3.7.3 Forcible Entry

Forcible entry of hoistway and elevator car doors should only be attempted under the direct advisement of an elevator mechanic or as a last resort during EMERGENCY REMOVAL PROCEDURES. The deformation of the doors and locks may add to the problem and delay the rescue. Upon completion of forcible entry operations have maintenance personnel secure the hoistway door or have police or security warn people of the danger.

Choose one of the following procedures based on the type of hoistway door.

A. Hinged door.

1. Knock out glass panel if present. If not, breach hoistway shaft above hoistway door

2. Push down roller, located near side opposite hinges, on shaft wall.

3. Open hoistway door.

4. Push open elevator car door.

B. Slide type door.

1. Maxi Force Air Bag System.

   This is the preferred forcible entry method. It is less likely than the others to push the door off its hangers or out of its track.

   a. Take a small purchase with a forcible entry tool.

b. Place bag between the leading edge of the door and jamb as high as possible to apply a more direct force on the linkage and the locking mechanism.

c. Position the bag to permit the center of the air bag to be as close as possible to the door edge, this increases the spreading capability of the air bag. It may be necessary to have a passenger in the car push open the car door to permit the air bag to obtain a good purchase.

d. Inflate air bag until hoistway door opens.

e. If necessary push open elevator car door.

2. Rabbit Tool

a. Use forcible entry tool to gain a purchase for the jaws of the rabbit tool.

b. Insert the jaws of the Rabbit Tool between the jamb and the leading edge of the hoistway door, as high as possible.

c. Ensure that the tool is flush with the hoistway door.

d. Operate tool to open door taking care not to cause the door to come off its track.

e. If necessary push open elevator car door.

3. Forcible entry tools

a. Go to landing directly above door to be opened.

b. Use a forcible entry tool to lift hoistway door out of its guide.

c. Tilt bottom of the hoistway door slightly into the shaft, just enough to allow the passing of a hook into the shaft.

Note: Care must be taken not to tilt the door too much. It may dislodge from hanger and drop into the shaft.

d. Use a hook to reach down to the lock arm mechanism and pull it up.

e. If necessary push open elevator car door.

C. Blind hoistway.

1. Determine the side of hoistway the car door faces.
2. Breach hoistway wall on that side.
3. Push open elevator door.

4. ELEVATOR PIT OPERATIONS

4.1 Elevator Pit Description.

The Elevator Pit is the lowest portion of the elevator shaft.

4.1.1 Types of Elevator Pits.

A. Jump Pits.

1. Usually 4' to 6' from lowest landing level to base of pit.
2. Elevator descends to within a couple of feet of the bottom of the shaft.
3. Pit is entered by opening the lowest hoistway door and using a portable ladder.

B. Walk In Pit.

1. Usually 6' to 10' from lowest landing to base of pit.
2. Car descend to the floor level above bottom of shaft.
    a. A high buffer and lower limit switch prevent the car from entering the pit.
3. Access to the pit is via a door located at the bottom of the shaft.
    a. Door is not required to have an interlock switch.
    b. Door is opened by a regular key. Emergency elevator keys are not usable.

4.2 Operations in Elevator Pits

4.2.1 Jump Pit.

A. Shut off elevator power switch.

B. Open the lowest hoistway door on shaft.

C. Use portable ladder to enter shaft.

D. For additional safety, trip lower limit switch and secure it in an open position.

4.2.2 Walk In Pit.

A. Shut off elevator power switch.

B. Enter via pit door.

C. If there is a fire in the pit, be cautious of the buffers (A device designed to stop a descending elevator beyond the normal limits of travel), they may be filled with combustible or inflammable liquid.

D. In an EXTREME EMERGENCY (immediate action necessary to save life) entry to a Walk in Pit before the elevator power switch is off may be made using the following precautions:

1. Open a hoistway door on shaft to be entered. The interlock will prevent car from moving

2. Use caution around mechanical and electrical components.

3. Turn off power as soon as possible.

5. FIREMEN SERVICE

All Fire Department personnel should be familiar with the operating procedure and limitations of Firemen Service. This section describes Firemen Service components and operational procedures. Section 6.4 outlines use of Firemen Service during fire operations.

5.1 Firemen Service Regulations.

5.1.1 Firemen Service is required in all elevators that serve three or more landings or travel 25 feet or more if plans for the elevator were filed after January 1, 1980.

5.1.2 Firemen Service elevators are required in all buildings classified in occupancy group E whose plans were filed subject to Local Law #5.

5.1.3 Firemen Service elevators are required in buildings classified in occupancy group E and deemed as an "existing building" under Local Law #5 if the building is 100 feet or more in height.

5.1.4 In all buildings classified in occupancy group E, 100' or more in height, the number of elevators that must be equipped for Fire Service is as follows:

A. Where a floor is serviced by three or less elevator cars, every car shall be equipped for Firemen Service.

B. Where a floor is serviced by more than three elevator cars, at least three elevator cars with a total rated capacity of not less than 6,000 pounds shall be equipped for Firemen Service. Such cars shall include not more than two cars which serve all floors, and at least one other car in another bank servicing that floor.

C. If the total load capacity of all cars servicing the floor is less than 6,000 pounds, all such cars shall be Firemen Service.

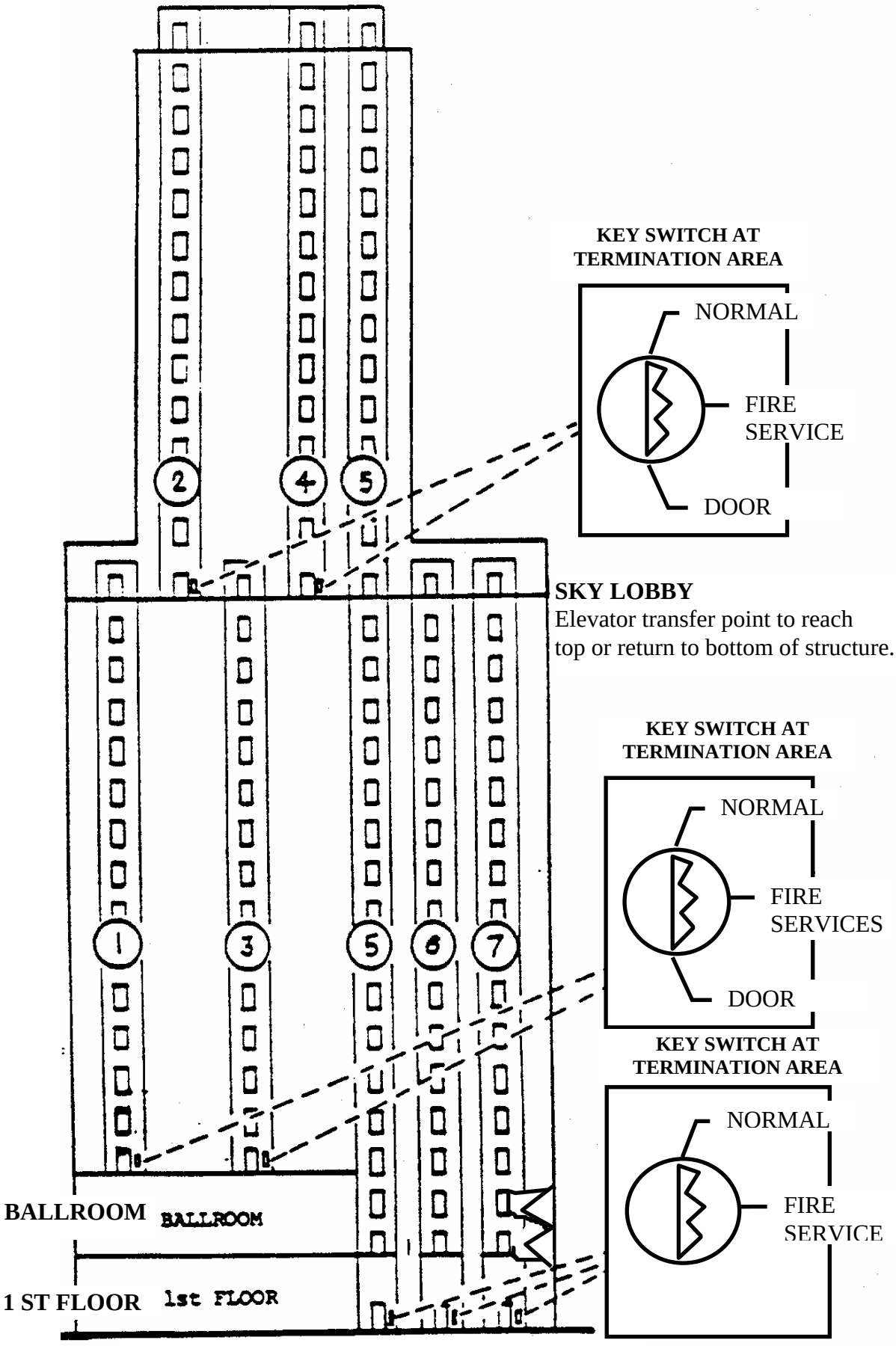
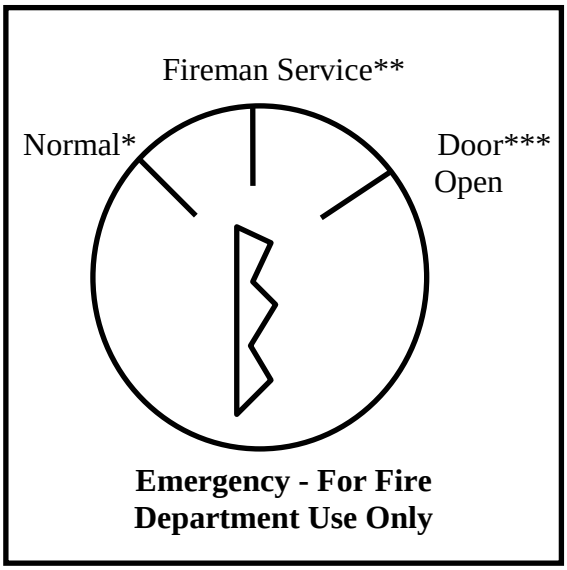


Fig. 1 Elevator Configuration

Fireman Service Lobby Switch Plates



Often Abbreviated as
Off *
On **
DO ***

Fig. 2A

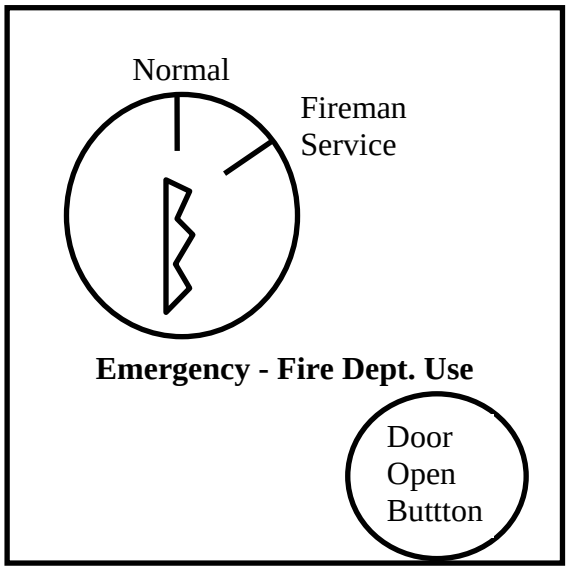


Fig. 2B

5.2 Firemen Service Controls.

5.2.1 Lobby Keyed Switch.

A. A switch at the street floor or terminal floor for each bank of elevators. Terminal floor is the lowest landing above the street floor of any elevator that does not serve the street lobby floor, also known as a Sky Lobby. (Fig. 1)

B. The key switch is required to be within 4 feet of the lobby call button.

C. The key switch is operated by use of the Fire Department key, or by city wide standard elevator key.

Note: Worn keys may not work.

D. Switch Configurations.

1. Three position key - Normal, Firemen Service and door open. (Fig. 2A)

2. Two position key - Normal and Firemen Service with a door open button. Door open button is required to be located in the same faceplate as the key switch. Button is only operable when key switch is in the Firemen Service position. (Fig. 2B)

Note: In both situations the cylinder face is approximately 1 1/2" in diameter and colored red. Switch faceplate is required to be inscribed "for fire department use only" or similar terminology.

E. The Normal and Firemen Service position in the keyed switch permit the removal of the key. The key is not removable in the door open position.

5.2.2 Elevator Car Keyed Switch.

A. Firemen Service keyed switch is provided inside each Firemen Service elevator car.

B. This switch is identified by red lettering "FOR FIRE DEPARTMENT USE ONLY" and has two positions. Normal and Firemen Service.

Note: Elevators approved for installation after March 1991 are required to be equipped with a three position switch:

NORMAL HOLD FIREMAN SERVICE

The Hold Position has the following features:

1. Permits the firefighter to remove the key from the switch.

2. Allows the firefighter to leave the car without the danger of an individual, without a key, moving the car to another location.

3. A firefighter with a key can move the car by changing the switch position from HOLD to FIREMAN SERVICE.

   THIS ACTION SHALL NOT BE TAKEN WITHOUT FIRST INFORMING THE FIREFIGHTERS OPERATING ON THAT FLOOR.

4. Elevator cars equipped with a two position switch are not required to be retro-fitted with a three position switch.

C. To operate the car, the switch must be placed in the Firemen Service position while the car is at the landing where the lobby keyed switch is located.

D. The lobby keyed switch must be in the Firemen Service position prior to placing the car keyed switch to Firemen Service.

E. Once the car switch is in the Firemen Service position it can not be overridden by the lobby keyed switch.

F. The key is not removable from the elevator car keyed switch when it is in the Firemen Service position.

5.3 Operation of Firemen Service.

5.3.1 Phase I - Recall Phase.

The recall of ALL elevators in the bank to the street or terminal floor either automatically or manually.

A. Manual Recall.

By the use of the key at the keyed switches located in the elevator lobby at the street floor or terminal floor.

Note: For elevators whose terminals are above the street floor (sky lobby), a two position keyed switch will be at the fire command station. The switch will allow the elevators to be brought down non-stop to their lowest floor landing. A three position keyed switch will also be at their terminal floor landing.

B. Automatic Recall.

1. Activation of elevator landing smoke detector.

2. Water flow from a sprinkler system.

Note: If the Firemen Service Phase I was initiated automatically by the activation of a lobby smoke detector or sprinkler water flow, the elevator cannot be returned to normal operation until the smoke detector or water flow alarm has been cleared.

C. Initiating Phase I Recall.

1. If Phase I (recall phase) has not been initiated upon arrival, Phase I shall be initiated and all cars accounted for and examined as they arrive at the street lobby floor.

2. If Phase I has been initiated before arrival and all elevator doors are closed, the following procedure are to be followed.

   a. Determine if Phase I was initiated manually or automatically.

   b. If Phase I was initiated manually the Firemen Service lobby keyed switch will be found in the Firemen Service position. Place the Firemen Service lobby keyed switch momentarily in the "Normal" (OFF) position. Then returned it to the Firemen Service position. This will cause all elevator car doors in this bank to open.

   c. If Phase I was initiated automatically (by lobby smoke detectors or sprinkler water flow), place the lobby keyed switch in the "Door Open" position. The doors of the Firemen Service cars will then open. In some older installations the doors of the non- Firemen Service cars will not open and must be opened by use of the emergency hoistway door key.

D. Results of Initiating Phase I Recall.

1. By placing the keyed switch in the Firemen Service position, all elevators in that bank will be returned to the street lobby or terminal floor.

2. An elevator traveling away from the street floor or from its lowest landing floor will reverse direction at the next landing without opening its doors, and return non-stop to the street lobby or terminal floor.

3. Doors opened at any floor will immediately close and the elevator shall return non-stop to the street or terminal floor.

4. Door reopening devices for power operated doors, which may be affected by smoke, heat or flame so as to prevent door closure, shall be rendered inoperative except for those mechanically activated by a safety edge.

5. "Emergency Stop" buttons will be rendered inoperative.

6. When the elevator car reaches its terminal floor, one of the following will occur:

   a. All car and hoistway doors open. The doors remain open for at least 8 seconds and no more than one minute and then close.

   b. All car and hoistway doors open. The Firemen Service elevator car and hoistway doors remain open with the car lights remaining on. Non Firemen Service elevator car and hoistway doors close between 8 seconds and one minute after opening.

   c. All elevator car and hoistway doors open and remain open. The car lights in the Firemen Service elevator cars remain on and the lights in the Non Firemen Service cars go off.

Note: Option "c" is required for all installations for which plans were filed after 1980.

Caution: Do not return the switch to the "normal" position at this time.

5.3.2 Phase II - Operational Phase.

The actual operation of the elevator car by use of the controls located within the car.

A. Operations:

1. Place the key in the car Firemen Service switch and turn to the Firemen Service position.

2. Press the car "Door Close" button and select a floor. It is not important which floor button is pressed first.

   a. In some elevator cars there may be two floor selection panels. The one to use for Firemen Service is the one nearest to or the one with the Firemen Service keyed switch.

3. As soon as the car begins to move, press the "Call Cancel" button to verify the operation of the "Call Cancel" button.

   a. If the car stops at the next available landing in response to the "Call Cancel" button, select the desired floor on the "Floor Selection" panel.

   b. If the car does not stop at the next available floor in response to the "Call Cancel" button:

      1) Immediately select the next available safe floor. If the car stops at the next available floor, press the "Door Open" button and leave the car. Notify the officer in command that the car is out of service.

2) If the car does not stop at the next available floor, attempt to stop the car by forcing the car doors open, thus interrupting the interlock relay switch. Notify the officer in command and initiate emergency evacuation procedures.

4. If more than one floor selection is made, the elevator car will stop at the nearest floor selection in the direction of travel.

5. If the car is operating normally when you reach the selected floor, press the "Door Open" button. You must keep your finger on this constant pressure button until the door is fully open, otherwise the door will close on its own. This is a built in safety feature.

6. If the doors open on heat and smoke, the simple removal of the finger from the "Door Open" button should enable the doors to close.

   a. If they fail to close automatically, press the "Door Close" button and manually assist the closing.

   b. If the car doors still fail to close, don Mask facepiece, evacuate the elevator and proceed to the nearest safe stairway.

7. When the elevator doors have fully opened, the elevator car will remain at the selected floor, with the doors open.

8. The elevator car shall not be returned to the lobby street floor until the officer has determined that the unit has arrived at the proper location.

   a. Due to internal building security, it is often necessary to force your way out of an elevator landing area on upper floors. Units may have to force their way from the elevator lobby to a fire stair or fire tower, either for reasons of safety or in order to operate. Someone should stay with the elevator, to see that it is not moved from the floor, until safe access to the fire stair or fire tower is assured.

9. To move from any floor, the "Door Close" button must be pushed, and another floor selected.

10. An elevator can be placed on Firemen Service or taken off of Firemen Service only when the car is at the landing where the lobby keyed switch is located.

11. Once a Firemen Service car has been placed in Phase II operation, it will continue in Phase II operation, regardless of the Position of the lobby keyed switch. This feature may be utilized to restore other cars in the elevator bank to normal operation, while the Fire Department continues to use the Firemen Service car or cars.

12. When an elevator car has been placed on Firemen Service, it shall be operated by a member equipped with a handie talkie and forcible entry tools.

5.3.3 Controls for Phase II.

A. Door Close Button.

1. It is a momentary touch type button.

2. Once fully opened the elevator car doors close only in response to the Door Close Button.

B. Floor Selection Button.

1. When the car is in Firemen Service, the car responds only to the floor selected by the Floor Selection Button in the car.

2. All elevator landing call buttons are rendered inoperable on landings served by this elevator.

C. Call Cancel (reset) Button.

1. The Call Cancel Button allows the operator to change floor selection or direction of travel prior to reaching the original selected floor.

2. When the Call Cancel Button is operated, the elevator car stops at the next available floor landing (i.e., the first floor, in the direction of travel, that the elevator is electrically and mechanically capable of serving). The doors remain closed. A new floor selection must then be made.

3. It is recommended that the Call Cancel Button be pressed whenever a member enters a car on Firemen Service to clear the floor selection panel of any previous floor selection that may have been made.

D. Door Open Button.

1. The elevator door opens only when the Door Open Button is pressed.

2. The Door Open Button must be held until the doors are fully opened.

3. If the Door Open Button is released before the doors are fully opened, the doors return to the closed position. This feature is provided so that the release of the Door Open Button will automatically close the doors in the event the car inadvertently stops at the fire floor.

4. Members leaving the elevator car must verify that the doors are fully opened. If the member leaves the car before the doors are fully opened, the door will close behind him, isolating the car and placing it out of service.

E. Emergency Stop Button.

1. The Emergency Stop Button is rendered inoperative during the Phase I operation.
2. The Emergency Stop Button should be operational during Phase II operation.
3. Activation of the Emergency Stop Button in Phase II will quickly stop the elevator car.

6. ELEVATOR OPERATIONS DURING FIRE OPERATIONS

6.1 General Procedures.

6.1.1 Account for all elevators serving the fire floor, checking them for victims.

6.1.2 When it is confirmed that the fire is on the 7th floor or below units should avoid the use of elevators. It is safer to utilize the stairway to reach the fire floor.

6.1.3 Do not use an elevator in a bank which services the fire floor if a lower bank of elevators reaches within five floors of the fire floor.

6.1.4 When it is necessary to use an elevator in a bank which serves the fire floor:

A. If Firemen Service is available, use a car with the Firemen Service feature.

B. Select a floor at least two floors below the fire floor or two floors below the lower level of an access stair in the fire area, whichever is lowest.

6.1.5 A service elevator shall not be used until it is declared safe for use by the officer in command of the fire. Be aware that in many high rise office buildings the service elevators have been converted for Firemen Service. Use of such an elevator must be avoided until declared safe by the officer in command.

6.1.6 Before entering the elevator car, all members shall have donned their mask. The facepiece shall be maintained in the standby position.

6.1.7 There must be a member equipped with a handie-talkie in each car whenever the elevator is in use.

6.1.8 Not more than six members are to be permitted in any elevator car. This precaution is required to prevent overloading.

6.1.9 Forcible entry tools must be carried aboard each elevator car.

A. In the event the car does not stop at the selected floor, a tool may be used to pry the elevator car door open disengaging the car door interlock.

B. In the event the car should become disabled a tool may be needed to extricate the members.

C. Tools may be required if elevator gives access into a secured area.

6.1.10 Elevator should be stopped every five floors (precautionary stops) to confirm that the elevator will respond to the selected floor. At each stop a new selection must be made.

6.1.11 Before leaving the lobby and at each precautionary stop direct a flashlight up between the elevator car and the hoistway shaft to determine if there is any accumulation of smoke in the elevator shaft.

6.1.12 The relationship of the elevator to the stairway should be noted. This can be accomplished by inspecting the "YOU ARE HERE" sign which is required to be posted at each floor near the call button. This should be done at the first and last precautionary stop. Floor configurations may change.

6.1.13 Determine as soon as possible if the location of the fire could affect the elevator operation.

6.1.14 Members must be careful during any emergency stop. They should prepare themselves for the jolt of a fast moving elevator car stopping abruptly.

6.1.15 If you are in a smoke filled hallway, remember, elevator doors will swing toward you and apartment doors will swing away from you. If the electric interlock malfunctions it might be possible to open the elevator door and not have the car on that floor.

Some elevator doors are of the sliding type. If forced by mistake due to smoke conditions, they may pop inward and be mistaken for an apartment door.

6.2 Affects of Fire on Elevator Components

6.2.1 Mechanical or electrical systems can become affected by heat or water causing erratic behavior of the elevator car.

A. Elevator car may move leaving a hoistway door in open position.

1. Consequences:

a. Injury to operating personnel.

b. Elevator shaft unprotected, possibly indiscernible in a smoke environment.

c. Delay in firefighting.

2. Precautions:

a. During fire operations do not straddle elevator doors to hold the car. Use Firemen Service if available or folded lengths of hose to hold car.

b. If the elevator moves leaving the door open close the hoistway door manually if possible.

B. Hoistway door warped by heat.

1. Consequences:

a. Interlocking device inoperative.

b. Elevator stalled in shaft.

c. Possibly trapped passengers in car.

2. Precautions:

a. If possible avoid using elevator cars that service the fire floor.

C. Malfunction of interlock of hoistway door.

1. Consequence:

a. Member might be able to open swing type door with no elevator car at landing.

2. Precautions:

a. Feel for floor before moving through door way.

D. General Precaution*:*

1. In any situation where the elevator operates erratically, exit the car at the nearest safe floor. Place the car out off service, either via the car controls or by blocking the car door. Notify the Officer in Command immediately.

6.3 Firefighters trapped in stalled elevator cars during fire operations.

6.3.1 Operations of Fire Department members in a stalled car.

A. If elevator car door opens on fire floor (heat, smoke), attempt to close the door.

1. Push Door Close Button.

2. Force door closed.

B. Select lower floor.

C. If car fails to move:

1. Check Emergency Stop Button, it may have accidentally been activated. Deactivate it by pulling it out, or if switch type, moving switch to off position.
2. Open Top Emergency Exit to relieve smoke in car.
3. Keep low in car.
4. If necessary don Mask facepiece. Remember it is important to conserve air.
5. Communicate situation to officer in command.
6. If necessary use side emergency exit for rope slide to the safety of lower floor. Have power removed to the adjacent car if this is to be attempted.
7. In an EXTREME EMERGENCY, Fire Department hose can be used to slide down to the floor below. If more than one length of hose is used, first tie the lengths together, then couple them.
8. Members can be lowered to the hoistway door interlock and exit at the floor landing below the fire.
9. Hose line on the floor below can be used to spray a fog stream between the car and the hoistway door. A 30 degree fog pattern should be used to cool and protect trapped persons during the rescue operation.

6.4 Firemen Service During Fire Operations

6.4.1 Assure the elevators serving the affected areas have been placed on Firemen Service.

6.4.2 When Firemen Service is available use the elevator cars so equipped.

6.4.3 First arriving units should, if possible, initially avoid a Firemen Service elevator which is capable of stopping at all floors. Many of the converted "Service" freight elevators are so arranged, and therefore are capable of being affected by fire on any floor. Only after the officer in command has determined that the fire is not adjacent to the shaft should these elevators be utilized. (Experience indicates that many fires in high-rise office buildings have been found in the service elevator lobby, in piles of collected rubbish. Heat and flame have affected the doors and control wiring of nearby service elevators).

6.4.4 Members shall never take a Firemen Service elevator which services all floors to go above the fire. When assigned to go above the fire via an elevator, choose an elevator which has a blind shaft on the fire floor. Remember a "Firemen Service" elevator is not necessarily a "safe" elevator. It can still be affected by heat, smoke or water entering the shaft. If there is no blind shaft elevator to go above the fire, stairs shall be used.

Note: Use a fire tower or a stairway other than the attack stair.

6.4.5 There are situations in which units will encounter "exceptions to the rules". Time must be taken to become familiar with particular elevators before leaving the lobby. Early manning by one or more members who have become familiar with the elevators is indicated. Utilize stairs whenever possible, and try to limit elevator use to those in banks that cannot be affected by the fire. Where elevator problems exist, consider calling in elevator company repairmen on emergency duty. Many high-rise buildings have these men on twenty-four hour call, and phone numbers must be posted in the elevator machinery room, and are often posted in the vicinity of the elevator lobby.

6.4.6 If Firemen Service elevators have not been installed in the building, Fire Department operations shall be conducted using elevators that have been placed in the "Manual Mode" if possible. When using elevators in the "Manual Mode" all the applicable sections of this procedural guide shall apply.

6.5 Operational Considerations

6.5.1 Locked Hoistway Doors.

A. For security reasons, some occupants lock the hoistway door on their floor when closing.

B. If your elevator arrives at the selected floor, but the car door does not open, make no attempt to force it. In this instance, the locked hoistway door, attached via the vane to the elevator car door, is keeping both doors closed. Any attempt at forcing them open may damage the interlock putting the car out of service.

C. If your car arrives at a floor and the car door opens revealing a locked hoistway door, the following considerations must be made:

1. If the hoistway door security lock can be removed or opened with no damage to the door, do so.

2. If removal of the locking device threatens any bending or warping of the door or door buck, make no attempt at removal. Warping or springing of the door assembly may interfere with the car's electrical circuits, putting the car out of service.

D. A preferable method, in both 1 and 2, is to drop down to a floor where exit is possible. Find the stair and move up to the original floor.

Note: In high rise buildings, on the street floor and above, any locks placed on passenger elevator car or hoistway doors must be openable with a key.

7. BUILDING CODE REGULATIONS EFFECTING FIRE DEPARTMENT OPERATIONS

7.1 Accidents.

7.1.1 The Building Department is required to investigate elevator accidents. Officers in command at such occurrences are to notify the Building Department via the dispatcher.

7.2 Mechanical Features.

7.2.1 The winding drum or traction sheave machinery are required to have a mechanical brake that is applied automatically when the power is removed from the system. The brake shall only release when the power is restored.

7.2.2 A manual power control switch for each elevator is to be located adjacent to, and visible from, the elevator machinery.

7.2.3 A mechanical safety device is attached to the car frame. It will be brought into play when any of the following conditions exist:

A. Car over speed.

B. Car free fall.

C. Slackening of the hoistway cable. Car safety devices will apply with downward motion of the car and may be released by reverse or upward motion of the car.

7.2.4 In automatic cars a transfer switch that puts the car solely under the control of the car operator must be provided. Elevator mechanics and some building service employees have operating keys.

7.3 Emergency Removal**.**

7.3.1 Emergency hoistway door key hole and keys themselves are to be of such a design that inhibits the use of common tools.

7.3.2 In a single car blind hoistway emergency access openings shall be provided at every third floor, but not more than 36 feet apart.

7.3.3 If emergency side exit door is provided it must have the following features:

A. Hinged to open into the car.

B. Locking device that requires the use of a key inside the door.

C. A means of being opened by hand from the shaft side.

D. Line up with the door of adjacent car.

E. Be within 3 feet of the adjacent car side door.

F. An electrical door contact that will prevent motion of the car when the door is open.

7.3.4 Top Emergency Exit.

A. Cars installed under the 1938 Building Code.

1. Top hatch required in all cars.

2. Opens outward.

3. Designed to unlock by thumbscrew from inside and outside of the car.

Note: To prevent access to the car roof by juveniles and vandals many have been bolted closed in the interest of safety.

4. May have a contact power switch.

B. Cars installed under the 1968 Building Code.

1. Top hatch required in all cars.

2. Opens outward.

3. Not required to be openable from the interior of the car.

4. Openable from exterior, wrench or screwdriver usually required.

5. May have contact power switch.

6. May be concealed by grill work, lights, mirrors or other decorative finish.

8. ELEVATOR TERMS AND DEFINITIONS

Alarm button (switch) **-** Button (switch) in elevator car which activates the alarm bell.

Car Door **-** Elevator car door.

Car Door Contact **-** An electrical device used to prevent the operation of the car unless the car door is in the closed position.

Car Safeties **-** Stop car in the event of an emergency. Controlled by car governor.

Counterweights **-** Used to counterbalance the weight of the elevator car.

Elevator Car Selector **-** Panel inside car containing emergency stop button, alarm button, door open button, floor selection buttons and Firemen Service key switch if required.

Elevator Control Panel **-** A visual display unit located in the lobby which indicates the status and location of all elevator cars and the necessary controls for the operation of the cars. Common in High-Rise buildings.

Elevator Door Vane **-** The connection between the elevator car doors and the hoistway doors. It allows the elevator car door to drive the hoistway door.

Elevator Machinery Room **-** Area where the equipment that raises and lowers the elevator is located. Usually located at the top of the shaft, machinery room may also be found at shaft bottom or two floors above the highest floor serviced by the elevator.

Elevator Motor **-** Turns winding drum raising and lowering elevator car.

Emergency Stop Button **-** Elevator car button which when activated cuts power to car and sounds alarm bell. Note: Do not rely on this button, elevator power switch must be used to insure motor power is off.

Emergency Escape Ladder **-** On the top of some elevator cars used to assist in top hatch removal operations.

Emergency Exit **-** Side door of a car in multi car hoistways.

Final Lower Limit Switch **-** A switch located in the elevator pit which prevents the elevator from descending too low in the shaft. When tripped by elevator it cuts the power to elevator motor. Acts as a backup to lower limit switch.

Firemen Service **-** A feature required in many elevators which enables the department to gain control of the elevators

Floor Call Button **-** Located at elevator floor landing, used to call car to the floor when service is desired.

Floor Selector **-** Located in the machinery room can be used to determine the exact location of the elevator.

Governor **-** Regulates elevator car speed. Also engages car safeties and shuts off electrical power in the event of free fall or over speed.

Governor Rope **-** A wire rope or cable which travels with the car. If engaged by the governor it mechanically activates the car safeties.

Hoistway **-** The shaft the elevator moves in. Types: Single car (local service), multi car (local service), single car blind (express service), multi - car blind (express service).

Hoisting Cable **-** Cable (cables) used to raise and lower the elevator.

Hoistway Door **-** door leading from landing to elevator shaft.

Interlock **-** A switch on hoistway door, and some emergency exits that will prevent the elevator from moving when in open position.

Limit Switch **-** A mechanical electrical device which is located at the top or bottom of the shaft. Its purpose is to prevent over extension of elevator car in an upward or downward direction.

Lower Limit Switch **-** A switch which stops the car in pit area, below lowest landing.

Main Electrical Power Switch **-** Located in machinery room, each switch controls the operation of one elevator.

Terminal Landing **-** lowest landing for discharge of passengers, may be at ground floor or above in which case it is known as a Sky Lobby.

Traction Sheave **-** Free turning pulley for elevator cables.

Ventilation Opening **-** "Smoke hole" - opening providing for the movement of air in the shaft caused by the movement of the elevator.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix E

AIR SUPPORT PLAN – HIGH RISE FIRES

DCN: 3.02.01 **A.U.C. 269**
September 9, 1993

AIR SUPPORT PLAN - HIGH RISE FIRES

Appendix E
Air Support Plan High Rise Fires AUC 269
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1. INTRODUCTION

1.1 In recent years, several high-rise fires have occurred throughout the world at which occupants became isolated from fire forces when they fled to the roof. Due to the media attention given to these events and the spectacular nature of helicopter evacuation, it can be anticipated that at future high-rise fires, people will ignore fire department advice and flee to the roof. Roof evacuation by helicopter is both hazardous and time consuming. Therefore, it shall only be undertaken as a last resort, and only upon the direction of the Fire Department Incident Commander (IC). However, large numbers of people on the roof cannot be ignored and the possibility exists that a helicopter approach may be the only access available.

At high-rise fires in which people were evacuated via helicopter, operations took a great deal of time, and presented an unwarranted risk to the rescuers and evacuees. FDNY observers who visited the scene of these fires concluded that evacuation was unnecessary since the people on the roof were never in any immediate danger. On the other hand, many of the fatalities at these fires were people who suffered smoke inhalation in the halls and stairwells while attempting to reach the roof. Had fire personnel been airlifted, ventilation and search of the stairwells and halls could have been effected. In order to address this problem, a plan to provide helicopter capabilities at high-rise fires has been developed in conjunction with the New York City Police Department.

2. DESCRIPTION OF THE AIR SUPPORT PLAN

2.1 Objectives:

2.1.1 Provide FDNY with the capability to place fire personnel on the roof of high-rise buildings, otherwise inaccessible due to fire conditions for the purpose of ventilation and search.

2.1.2 Control, comfort and direct people who view themselves as trapped and remote from help.

2.1.3 Provide the lobby command post with intelligence on roof conditions.

2.1.4 Evacuate persons in need of immediate medical attention.

2.1.5 Provide the capability to evacuate the roof as a last resort.

2.2 The plan is divided into three phases:

ALERT: Notification is made by the Manhattan Fire Department Dispatcher direct to the Police Aviation Unit upon transmission of a third alarm for a fire in a high-rise building.

ASSEMBLE: Fire Department units, Police Helicopters and Rappelling Team are assembled at a selected mobilization point.

AIRLIFT: Air Support Teams are airlifted to the vicinity of the roof of the fire building, pending the decision of the IC to actually land members on the roof.

2.3 Criteria For Use:

2.3.1 The decision to "Assemble" rests with the IC at the fire. The conditions under which Assembly may be ordered are generally, but not limited to:

A. Fire located above 10th floor in a high-rise building.

B. Access to the roof limited to exterior of building, via helicopter.

C. Fire in possession of two or more floors.

D. Interior access routes above fire blocked.

2.3.2 The decision to "Airlift" may be made only by an IC who is at the staff officer level.

2.3.3 If the decision is made by the Fire Department IC to utilize the High-Rise Support plan the operation shall be in conformity with guidelines contained in this document. This decision rests with the Fire Department IC until fire operations are completed.

2.4 Mobilization Points:

In the event of a major high-rise fire in the midtown area, most 3rd Division units will be engaged and streets in the midtown area are likely to be clogged with traffic. Similarly a high-rise fire in lower Manhattan, will involve most 1st Division units. For this reason, two high-rise helicopter mobilization points have been selected, each with a different High-Rise Roof Chief (HRRC) and different High-Rise Roof Teams (HRRT).

2.4.1 High-Rise Fire South of 23rd Street:

Mobilization Point	E. 34 St. Heliport.
HRRC's	Battalion 8, 9
HRRT's	Ladder Co. 2, 7, 21

2.4.2 High-Rise Fire North of 23rd Street:

Mobilization Point	Wall St. Heliport
HRRC's	Battalion 1, 4
HRRT's	Ladder Co. 6, 10, 15

2.4.3 For fires in high-rise buildings in other parts of the City, the selection of a mobilization point will be determined by the Manhattan Supervising Dispatcher.

3. PERSONNEL AND EQUIPMENT INVOLVED

3.1 High-Rise Roof Chief (HRRC) Duties

3.1.1 Upon order to "Assemble", respond to the designated mobilization point and rendezvous with the Police helicopters and Rappelling Team.

3.1.2 Obtain the following information through the Dispatcher while responding to the mobilization point:

A. Command channel

B. Tactical Channel for HRRT

C. Identification of Attack and Evacuation Stairs

D. Identification of the stairs that lead to roof

3.1.3 Notify the IC of the fire through the dispatcher when the High Rise Roof Teams, the Police helicopter/s and the Rappelling Team are assembled at the mobilization point.

3.1.4 Insure that HRRT's are on the proper handie-talkie channel prior to lift off.

3.1.5 Monitor both the Command channel for contacting the Lobby Command Post and the Tactical channel for communications with the HRRT. To accomplish this, it will be necessary to take the Battalion firefighter's handie-talkie.

3.1.6 If hardwired communication is established (warden phone, standpipe phone, telephone) use an HRRT member to assist with communications.

3.1.7 Be equipped with SCBA (Self-Contained Breathing Apparatus) and clipboard.

3.1.8 The HRRC's Battalion firefighter will remain at the mobilization point to provide security for the Battalion car and HRRT apparatus.

3.1.9 The HRRC's Battalion firefighter must obtain keys to both HRRT apparatus. If additional equipment is needed a helicopter will return to the mobilization point to transport it. The Battalion firefighter will monitor the department radio for instructions.

3.1.10 Upon the order to "Airlift", the helicopter will fly the HRRC and Rappelling Team to the fire building where the HRRC will make observations from the air and advise the IC to the need and advisability of a roof landing. If the IC orders a roof landing, the Police personnel will rappel and gain control of building occupants on the roof, prepare the roof for landing and guide the aircraft to land. The HRRC will advise the IC of the need for fire personnel on the roof. If the IC authorizes the placing of Fire Department personnel on the roof, a second helicopter will land the HRRT and the high-rise roof kit (HRRK). The HRRC will be in command of roof operations. If necessary, an additional HRRT can be airlifted to the roof.

3.1.11 Battalions 1, 4, 8 & 9 have been trained as HRRC's. If they are unavailable, any battalion may be selected.

3.2 High-Rise Roof Team (HRRT)

3.2.1 An HRRT consists of a ladder company made of an officer and five firefighters. Upon the order to "Assemble", the Manhattan Dispatcher will notify two HRRT's to respond to the designated mobilization point. The HRRC will designate units as primary and secondary HRRT. The primary HRRT will load the HRRK aboard the second helicopter and board the aircraft.

3.2.2 Upon the order to "Airlift", the primary HRRT will fly to the fire building and remain airborne in the vicinity of the fire building until landing is authorized by the IC via the HRRC or directly from the Command Post. Upon landing, they will operate under the HRRC. The secondary HRRT will remain at the mobilization point and await orders.

3.3 High-Rise Roof Kit (HRRK) See Fig. 1

3.3.1 Due to space and weight considerations aboard the helicopter, the only tools and equipment included in the High-Rise Roof Kit are:

A. 6 SCBA with 1 hour cylinder
B. 1 Bolt Cutter
C. 2 Halligan Tools
D. 2 Axes
E. 2 Search Ropes
F. 1 Rabbit Tool

3.3.2 Only these tools are to be brought to helicopter operations.

3.3.3 Tools shall be stowed on helicopter as per directions of Aircraft Commander.

3.4 NYPD Aviation Bureau

3.4.1 Under normal conditions, it can be anticipated that a time span of 30 to 40 minutes can be expected between the order to "Assemble" and pickup of fire personnel at the mobilization point. This time lag should be given consideration in the strategy of Incident Commanders at high-rise operations.

3.4.2 If two helicopters are available, the first will carry the HRRC and the Police Rappelling Team. The second will carry High-Rise Roof team. If only one helicopter is available, it will return to the Mobilization Point to pick up the HRRT after depositing the HRRC and the Rappelling Team on the roof.

3.5 N.Y.P.D. Emergency Service Division

The Police Emergency Service Division provides two important components of the Air Support Plan: A Command Post Communication Liaison and a Rappelling Team

3.6 Command Post Communication Liaison

3.6.1 Upon order to "Assemble", the nearest available emergency service radio car will be dispatched to the fire building. Their portable Special Operations Division (SOD) radio will be used in the Lobby Command Post to provide the Incident Commander (IC) of the fire with direct communication with the helicopter and the Rappelling Team on the roof.

3.6.2 Police Aviation will provide a radio headset in the helicopter for the HRRC to monitor the SOD channel.

3.6.3 One member of the Rappelling Team with a SOD radio will remain with the HRRC on the roof to act as a communicator with the helicopters and as a backup communication link with the Lobby Command Post.

3.7 Rappelling Team

"Rappelling" is defined as the "activity of lowering oneself by means of ropes onto a designated target". The duties of the Police Rappelling Team at a high-rise fire are as follows:

3.7.1 Control, comfort and direct persons who have fled to the roof. Until order is established, the helicopter cannot land for fear that people may rush to the aircraft causing injury to themselves or disability to the craft.

3.7.2 Preparation of the roof for helicopter landing.

3.7.3 First Aid - Tend to the immediate medical needs of people on the roof, freeing fire personnel for ventilation and search.

3.7.4 Ground Crew for Helicopters - the Team leader acts as landing officer, directing the helicopters to the landing site. Team members will also direct persons on and off the aircraft.

3.7.5 Communications - Provide communications for HRRC as per sec. 3.6.3

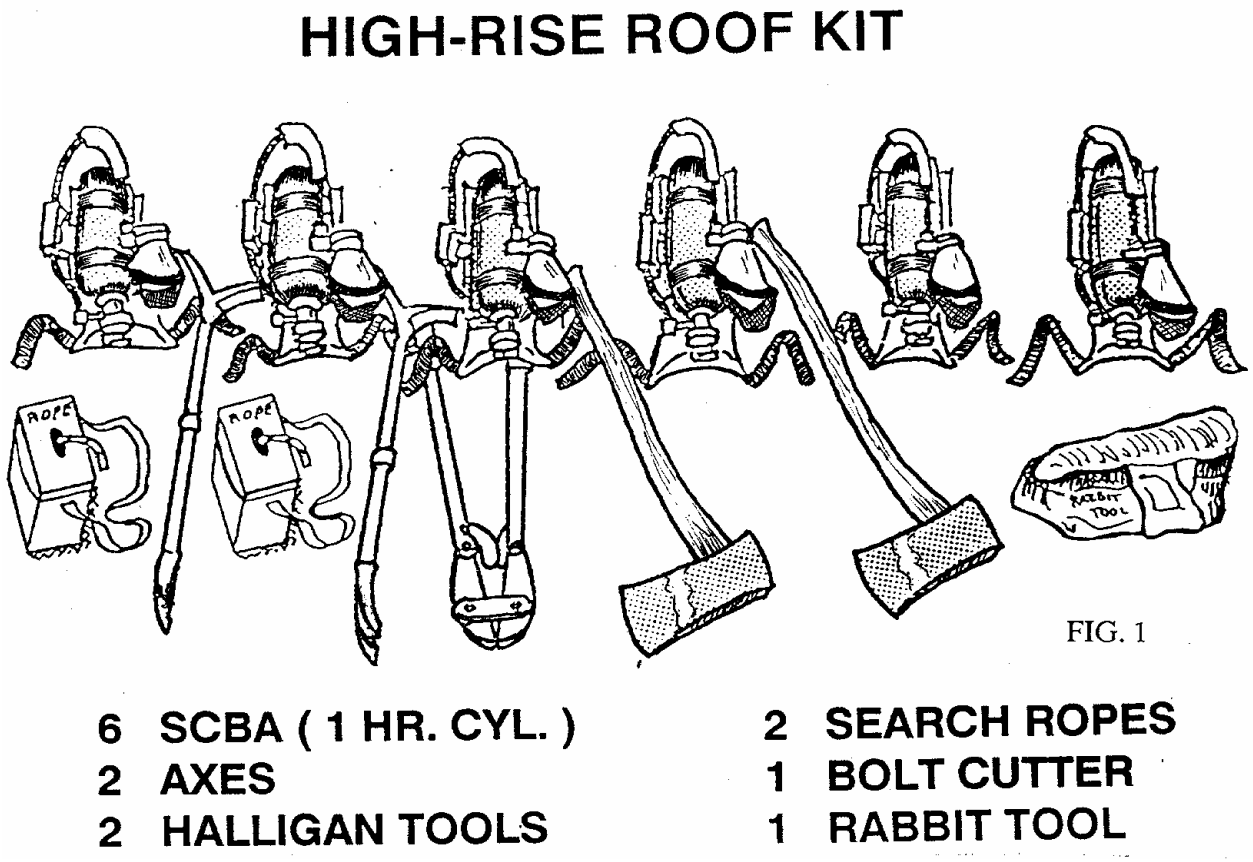

FIG. 1

4. AIR SUPPORT PLAN OPERATIONS

4.1 Alert Phase

Upon receipt of a third alarm for a fire in a high-rise building the Manhattan Fire Department Dispatcher will contact the Police Aviation Unit.

The purpose of the "Alert" phase is to allow the Police Aviation Unit time to prepare for Air Support Operations.

There will not be any movement of Fire Department personnel in this phase.

4.2 Assemble Phase

4.2.1 The IC at a high-rise fire will give the order to "Assemble" via Manhattan Dispatcher.

4.2.2 The Manhattan Communications Office will:

A. Notify the Police Dispatcher via Police City-Wide radio of the fire and to “Assemble" the Air Support Teams, at the proper mobilization point. (Sec. 2.4) Follow-up notification will be made by phone.

B Have the designated HRRC and HRRT respond to the mobilization heliport, or provide units if they are unavailable. This information must be transmitted to the Command Post at the fire building.

C. Obtain information required in Section 3.1.2 and relay to the HRRC.

4.2.3 The Police Operations Division will notify the Aviation Bureau and the Emergency Service Rappelling Team to respond to the mobilization point.

4.2.4 An Emergency Service radio car will be dispatched to the Fire Department Command Post at the fire scene for use of the SOD radio.

4.3 Airlift Phase

4.3.1 Upon the order to "Airlift," units at the mobilization point will proceed via helicopter/s to the vicinity of the roof of the fire building, pending the decision of the IC to actually land members on the roof.

4.3.2 Operate in accordance with orders received from the Command Post and with applicable sections of this circular.

5. SAFETY

5.1 All Department personnel must observe the following safety rules:

5.1.1 Approach and leave the helicopter only within the field of vision of the pilot and only from the front. (See Fig. 2).

5.1.2 Do not approach the tail section under any circumstances.

5.1.3 Approach and leave the aircraft in a semi-crouched position. Do not run.

5.1.4 Raise nothing above the head in the vicinity of the helicopter.

5.1.5 Each member will carry his/her mask and assigned tools to the helicopter. There must be no unnecessary movement in the area of the helicopter.

5.1.6 When loading HRRK, one member will enter the cabin and stow the equipment as it is passed to him/her.

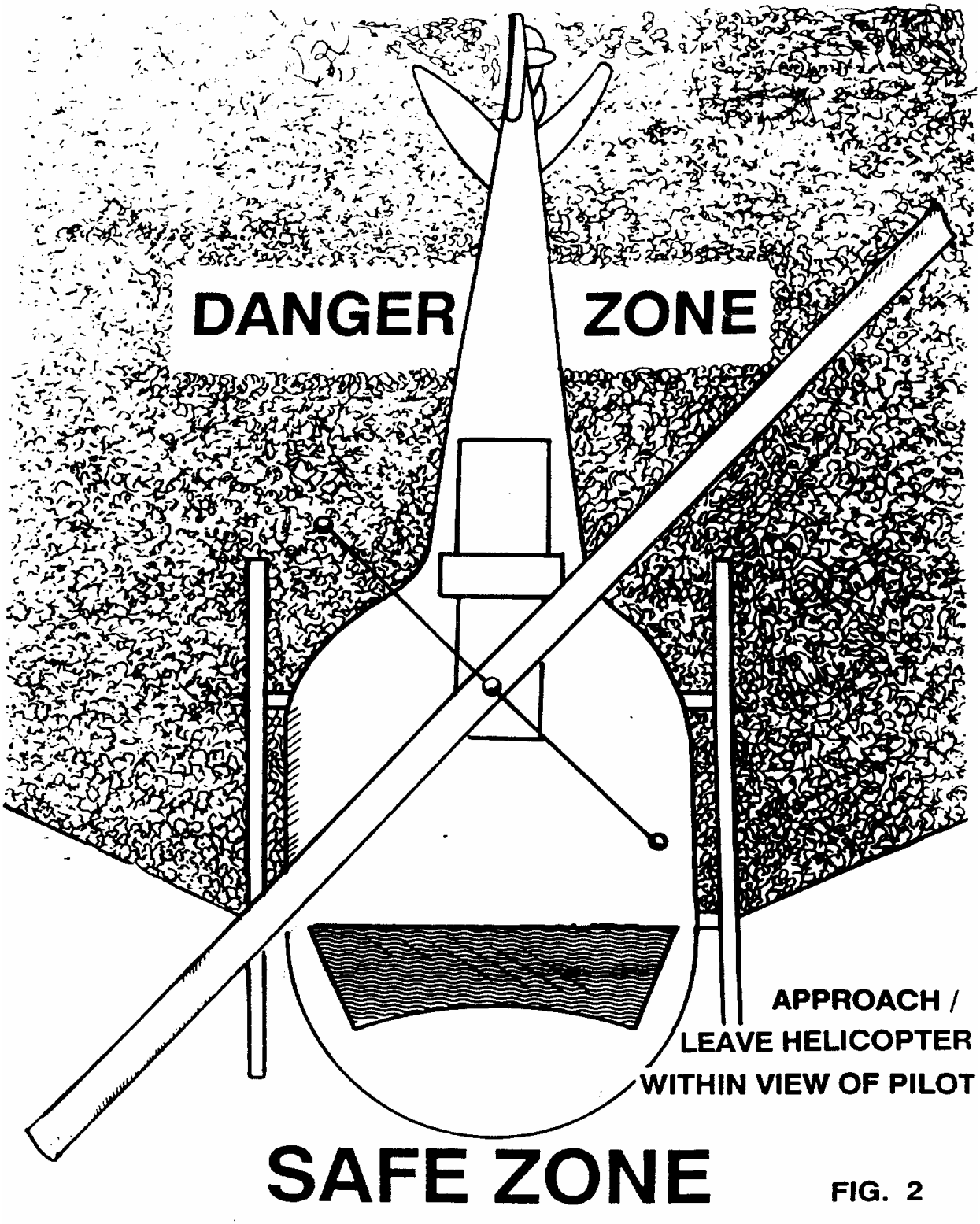
DANGER ZONE
APPROACH / LEAVE HELICOPTER WITHIN VIEW OF PILOT
SAFE ZONE

FIG. 2

5.1.7 Riding positions on the helicopter are designated by the Aircraft Commander.

5.1.8 Do not step on or place tools on or near the rubber pontoons of the helicopter.

5.1.9 Leave the helicopter only when directed by the pilot or co-pilot.

5.1.10 Be alert for other helicopter landings and takeoffs.

5.1.11 Due to unpredictable effect of ventilation in high-rise buildings, interior stairs or shafts must not be vented unless ordered by the IC of the fire.

5.2 The HRRT Officers' prime function during loading and unloading of the of the helicopter is to maintain direct control over the movement of his/her members.

The HRRT officer will:

5.2.1 Approach the helicopter after receiving the signal from the pilot.

5.2.2 Maintain a position alongside the helicopter at the rear of the compartment door.

5.2.3 Control approach of members.

5.2.4 Supervise loading/unloading.

5.2.5 Be the last one to board and the first to leave helicopter.

5.2.6 Monitor handie-talkie during flight.

5.2.7 Maintain same position by door during unloading.

5.2.8 Control route of members leaving helicopter.

5.2.9 Select an "assembly" area near bulkhead or other roof projection away from landing area, and have members proceed immediately to it.

6. PROGRAM MAINTENANCE

6.1 The Manhattan Borough Commander is the PROGRAM OFFICER and is responsible for:

6.1.1 Liaison with the N.Y.P.D.

6.1.2 Condition of all equipment required for the program.

6.1.3 Training.

6.1.4 Notifying the Bureau of Operations when major drills are planned.

6.1.5 Forwarding reports when items requiring the attention of the Chief of Operations surface.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix F

APPROVED SAFETY BULLETIN 67

APPROVED RIDING POSITIONS ON APPARATUS

APPROVED RIDING POSITIONS ON APPARATUS

Appendix F
Approved Safety Bulletin 67 Approved Riding Positions on Apparatus
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1. Prior to the establishment of a riding position policy in November 1971, falls from a moving apparatus were averaging one a month. This number his been reduced; nevertheless five members fell from an apparatus in the year 1981 and four members have fallen in the first nine months of 1982.

2. Vehicular accident records of this Department indicate that the location of members on moving apparatus can be the difference between a safe trip or serious injury and even death. Choice of riding location has been an important factor in cases where the apparatus has hit a bump or depression in the road, made a sharp or unexpected turn, or was involved in an accident.

3. This bulletin classifies and illustrates riding positions in order to provide safer transportation of members. At the start of each tour, officers shall select riding locations commensurate with the number of members working, and assign each member a location. (See Pages 4 and 5, Examples of Riding Positions).

   Officers shall enter each member's location on "Riding List" (BF 4). Responsibility for enforcement rests on the officer, and responsibility for compliance rests on the individual member.

4. Bearing in mind that an enclosed, seated, belted position is the safest location while riding an apparatus, officers shall assign these positions first. The officer then assigns positions in a descending order of priority. Ex.: 1. Enclosed, seated, belted position; 2. Seated, belted position; 3. Standing - side positions/ with restraining devices; 4. without restraining devices.

   The rear step of the apparatus is never to be used as a riding position. Its sole function is to load and unload hose.

5. Members assigned to standing locations must maintain a firm grip at all times with both hands. If vertical hand rails are used, members should buttress themselves by using a second hand hold with their other hand. Remember, members must hold on with both hands...they are not to break their grip (to don clothing, reach for a tool, or change locations) while the apparatus is moving. Members must accept their personal responsibility to protect themselves to the greatest degree possible. When gates or guards are provided on side standing locations, they must be in place for proper protection.

6. Under no circumstances shall members sit on battery box, running board, steps, or turntable. Only designated seats, or other approved locations, shall be used. Where seats are provided, they shall be used.

7. The major part of the responsibility for falls from apparatus and resultant injury rests with the member who fell. Each member must recognize and accept this responsibility. Each individual member must take steps to prevent himself from falling from a moving apparatus.

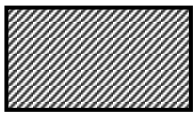
8. Reasons for such falls have been:

    1. Sitting on turntable, or battery box.
    2. Not prepared for unexpected turn.
    3. Holding on to portable ladder which worked loose.
    4. Changing position of hands on straps or other hand holds.
    5. Apparatus making a turn or sudden stop.
    6. Reaching for a tool, mask, etc., before fire apparatus had stopped.
    7. Moving while apparatus is traveling.
    8. Donning fire clothing while apparatus is in motion.
    9. Not using available seat belts.
    10. Loose grip on hand rails.
    11. Lack of communication between Officer, chauffeur, and members riding, when apparatus stops and suddenly starts moving, catching members off guard.

    Note: A recent court case (New York State Court of Appeals) indicates that failure to use a seat belt is a factor which may be considered in compensating accident victims.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

DEFINITIONS

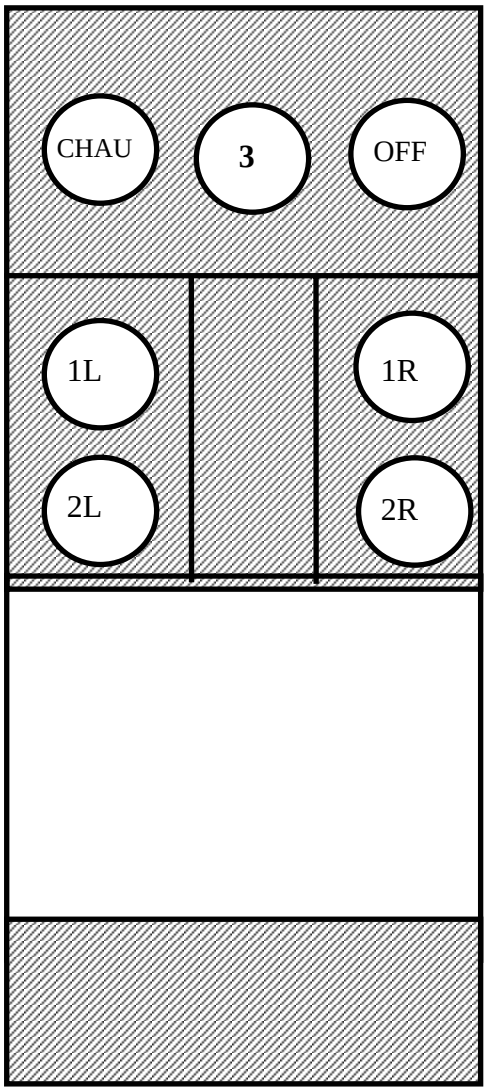
OFF	RIDING LOCATION OF OFFICER
CHAU	RIDING LOCATION OF ECC AND/OR QC
TILL	RIDING LOCATION OF TILLERMAN
	INDICATES AREA OVERHEAD IS COVERED
L	INDICATES LEFT SIDE OF APPARATUS
R	INDICATES RIGHT SIDE OF APPARATUS
C	INDICATES CENTER SEAT

NOTE: Numerals in circle, in front of letters "L" or "R' indicate priority. (Unless otherwise indicated.)

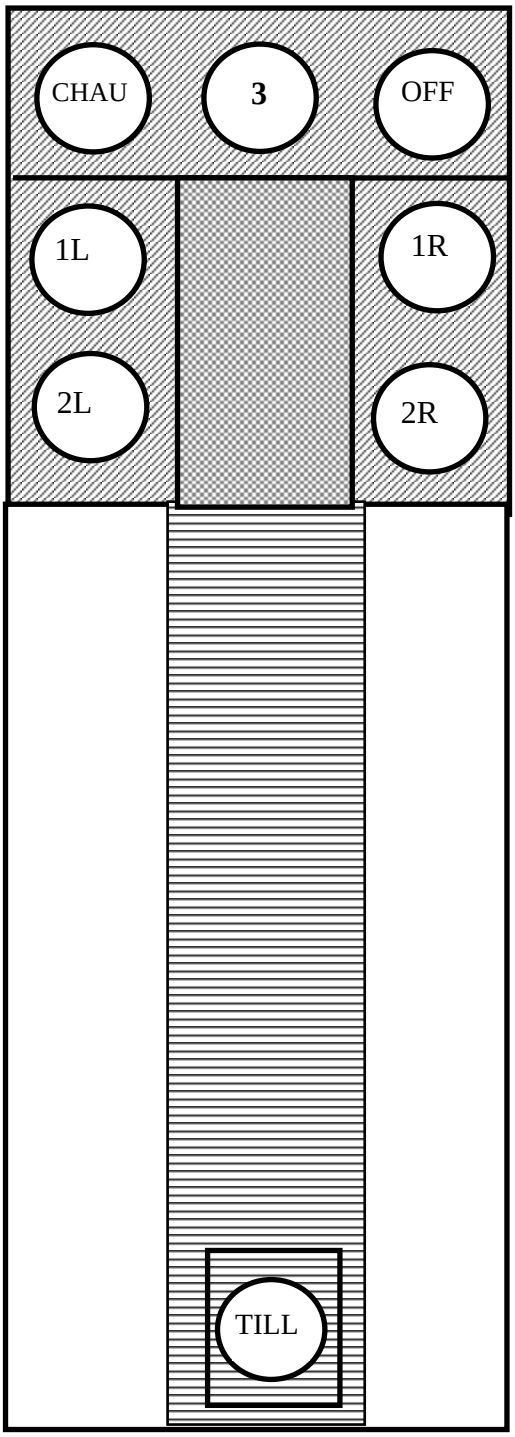
EXAMPLES:

1L	Indicates first priority and left side of apparatus
3R	Indicates third priority and right side of apparatus

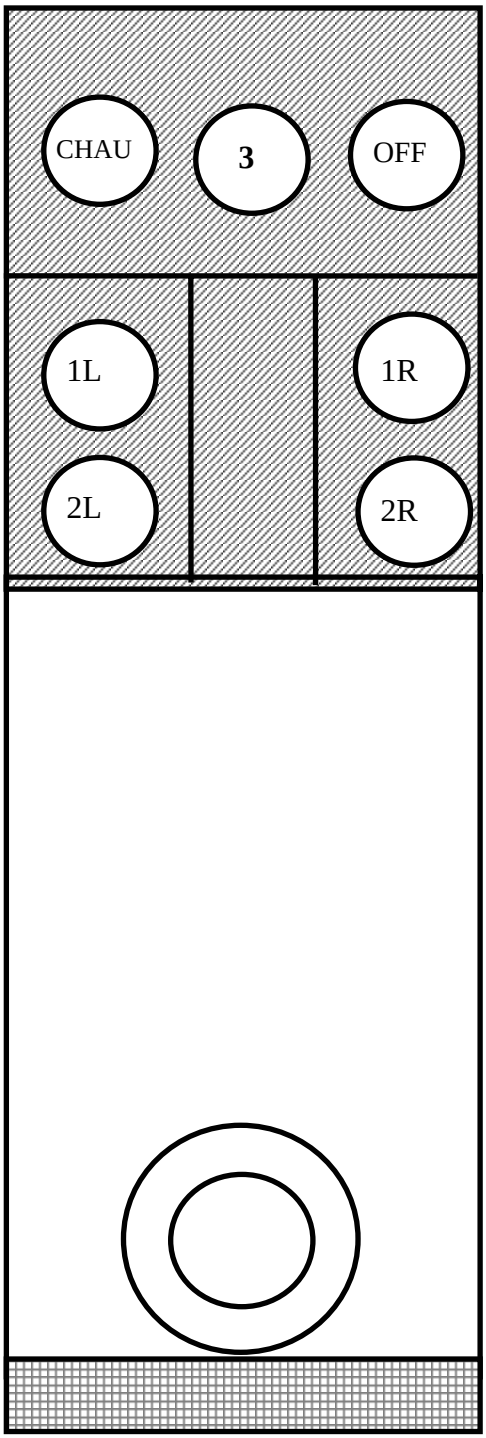
Example Of Pumper Riding Positions



Example of Ladder Riding Positions (Tiller Type)

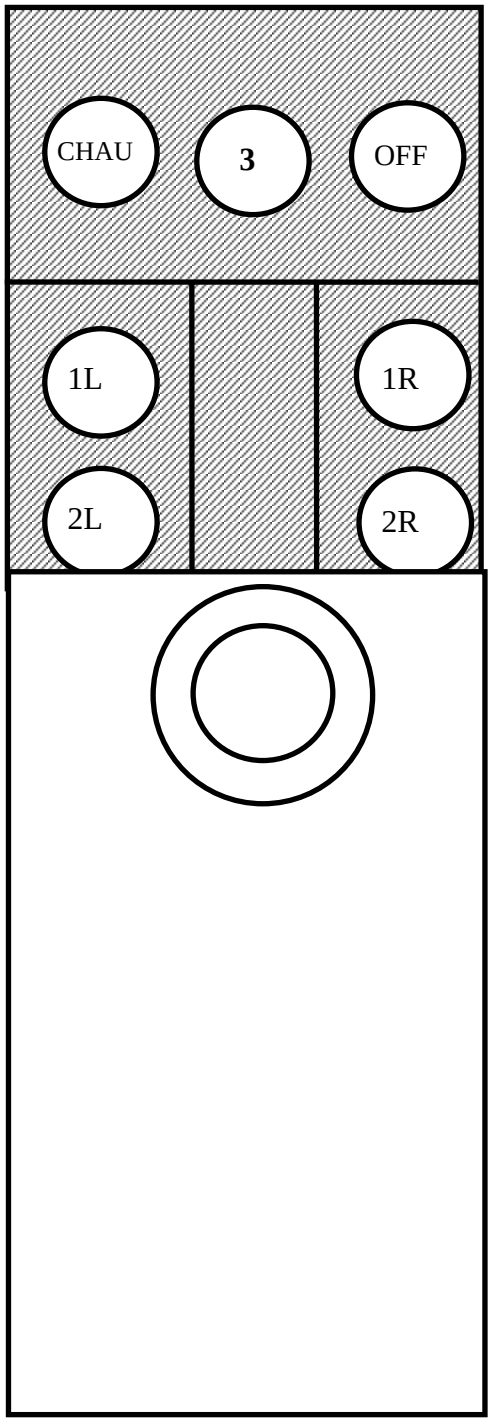


Example of Ladder Riding Positions (Rear Mount)



Note: It is absolutely prohibited to ride on rear step.

Example of Ladder Riding Positions (Tower Ladder)



Appendix G
TRAINING BULLETIN TOOLS 22 PORTABLE COMMAND POST

PORTABLE COMMAND POST

Appendix G
Training Bulletin Tools 22 Portable Command Post
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1. INTRODUCTION

The Portable Command Post will assist the Incident Commander in efficiently executing the responsibility of incident management.

The Portable Command Post (PCP) will be carried in the division vehicle. Deputy Chiefs shall utilize the PCP at fires, emergencies and other incidents here its deployment will assist in the operation.

2. ADVANTAGES

2.1 Establishes a Fire Department Command presence at the scene.

2.2 Serves as a physical focal point for incoming Fire Department Units as well as other agencies reporting to the operation.

2.3 Provides a convenient means of direct radio communication with the Borough Communications Office.

2.4 Facilitates the recording of the location and status of Fire Department units.

2.5 Facilitate the recording of the ranking official present from other agencies.

2.6 When manned by an aide, the Incident Commander will be freed from the distraction of units and agencies reporting in to the operations.

2.7 Satisfies federal regulations regarding the establishment of a Command Post.

2.8 Provides own light for viewing and recording information.

2.9 Improve safety by promoting accountability of personnel, efficient use of resources and tactical planning.

2.10 As a visual aid the PCP will assist Incident Commander in assigning chief's area of responsibility.

3. DESCRIPTION

Portable Command Post is comprised of three components: case, power pack and stand.

3.1 Case - welded aluminum 18" X 28" X 8" containing the following:

3.1.3 Vertical Magnetic Surface (Figure I)

A. For recording box, time out, incident location and height, construction, dimensions if building involved.
B. Hold supply of magnetic identifiers.
C. Radio console
D. Light

3.1.2 Horizontal Magnetic and Marking Surface (Figure 2)

A. For recording unit location or status:
- ♦ Standby
- ♦ R&R
- ♦ Tactical location on diagram

B. For recording outside agencies' representatives

3.1.3 Magnetic Identifier (Figure 2)

A. Each division is supplied with pre-labeled identifiers of units they most frequently respond with.
B. Unmarked black identifiers are also supplied. Unit numbers can be written on with dry marking pens supplied with the post.
C. Additional permanent identifiers can be made using Dymo Label Makers with 1/2" tape.
D. Color coded:

Engine .....Black
Ladder & Tower Ladder .....Red
Battalions .....Gold
Special Units .....Blue
Sectors.....Purple

3.1.4 Radio

A. Motorola max trac
B. 25 Watt
C. 6 Channel

1 - Citywide
2 - Queens
3 - Brooklyn
4 - Manhattan
5 - Bronx/Staten Island
6 - Not in use

D. Antenna

- ♦ Magnetic base
- ♦ Place on a ferrous metal object.

Caution: Antenna must not be placed on Portable Command Post or within 3' of people.

3.1.5 Power supply compartment (Figure 3)

A. 12 volt maintenance free lead acid battery. Operational time averaging between 3 - 4 hours.
B. Charging plug
C. Wiring and terminal blocks
D. Micro switch which stops battery from charging when case is closed.

3.1.6 Rain shield - clear plastic attaches to top and bottom portions of case with velcro strips. Keeps PCP dry preventing icing on surfaces and running of dry markers.

3.1.7 Command Post Flag (Figure 3) - orange flag which fits in hole in top right-hand corner of case.

3.1.8 Light (Figure 3) - turn off when not in use to conserve battery.

3.2 Power pack (Figure 3) - battery charger with special plug which permits its use only with PCP.

3.2.1 Charger fed by 110 volt service and supplies 12 volts of DC current to PCP power plug.

3.2.2 PCP is supplied through charging plug located on left side lower portion of case.

3.2.3 Power pack should always be taken to location of the PCP. Necessary preparation should be made to permit its deployment.

3.2.4 Power pack is to be used during extended operations or if PCP battery is low.

3.2.5 Unit fits on the leg rails of the PCP. There it will be approximately 4" above the ground protected from runoff. Case will provide some protection from rain and stream spray.

3.3 Stand - (Figure 3)

3.3.1 Consists of folding aluminum legs which pivot at the center and nylon straps used to support the PCP case.

4. LOCATION

The following guideline are to be used in selecting site for PCP placement.

4.1 Where possible location should afford the Incident Command with a good view of operation.

4.2 Clearly visible to incoming units and other agencies.

4.3 Avoid loud noise areas such as a location adjacent to operating pumper or tower ladder.

4.4 Avoid areas likely to be sprayed with stream.

4.5 Avoid area likely to be disrupted by expanding operations.

4.6 When practical locate PCP near a vehicle or apparatus which would permit mounting of radio antenna.

5. SETTING UP PCP (Figure 3)

5.1 Place stand on firm flat surface.

5.2 Place PCP case on stand, open case and lock hinge arms.

5.3 Place magnetic base antenna on ferrous metal such as vehicle or apparatus.

5.4 Turn on light if necessary.

5.5 Turn on radio, insure it is set to Borough of incident's location.

6. USING PCP

6.1 Draw diagram of incident on horizontal surface.

6.2 Take appropriate unit identifier from vertical surface and place them on diagram according to location and duties assigned.

6.3 Utilize PCP radio for transmitting reports.

7. PRECAUTION

7.1 Antenna is not to be placed on portable Command Post.

7.2 Keep antenna at least 3' from people.

7.3 P C P lid must be open while charging its battery to prevent hydrogen build up and possible explosion.

7.4 Do not overcharge battery.

7.5 Portable Command Post could be blown over by high wind. During windy conditions, if unable to find appropriate sheltered area, position PCP to avoid wind from striking post from the operating side.

7.6 P C P will be carried in a secure place in the vehicle. If necessary protect it from damage caused by movement.

8. MAINTENANCE

8.1 Test radio weekly

8.2 Charge battery one hour per week and after each use.

8.3 Arrangements for repairs shall be made through the Bureau of Fire Communications.

Figure 1

VERTICAL MAGNETIC SURFACE

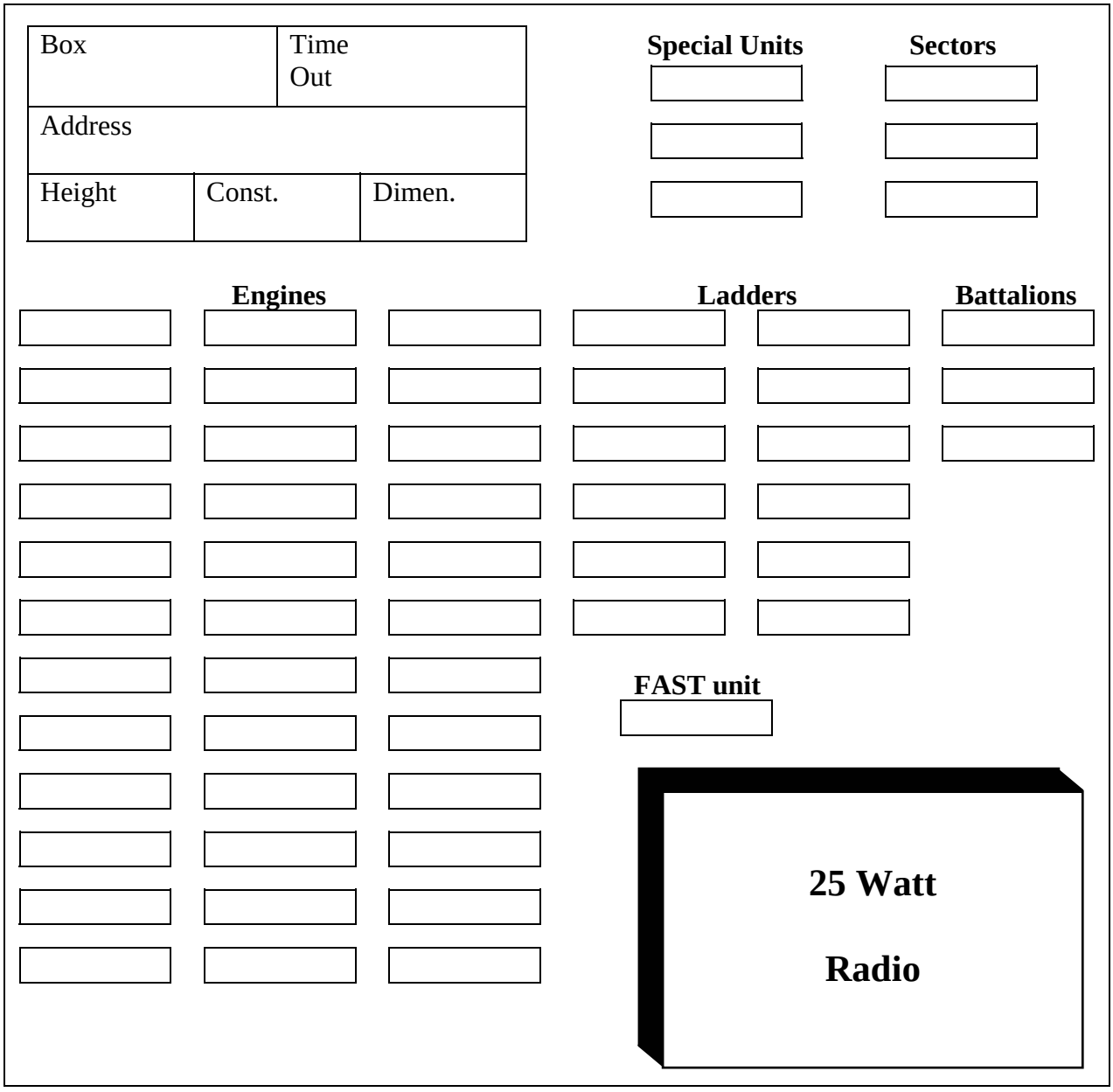
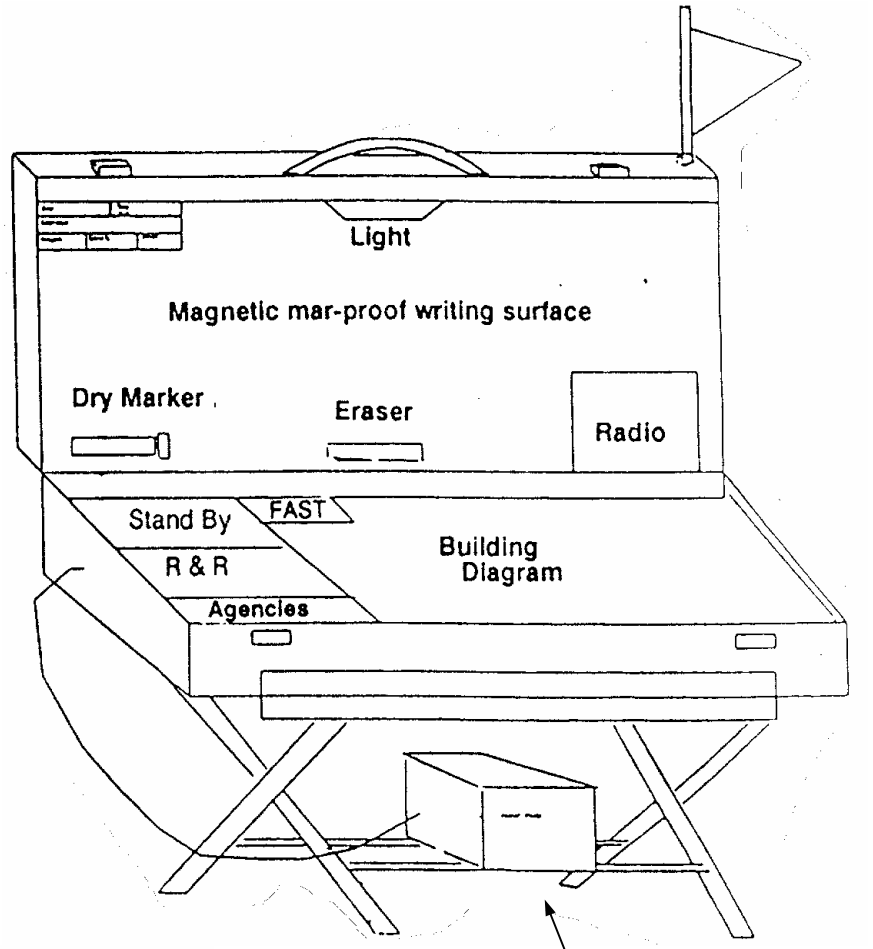


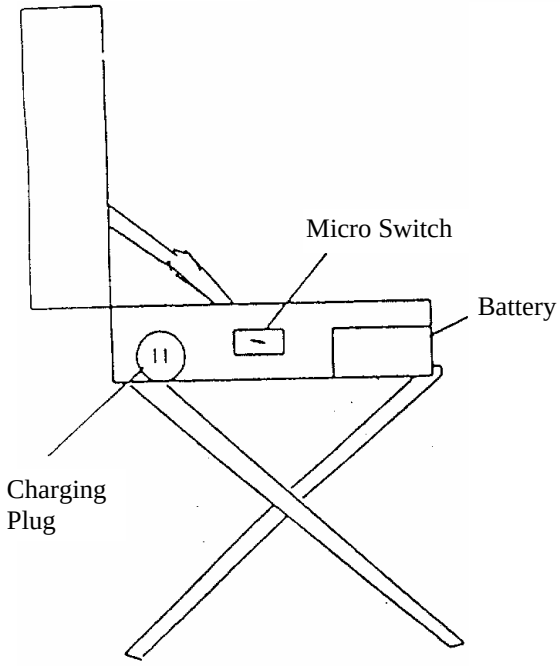
Figure 2

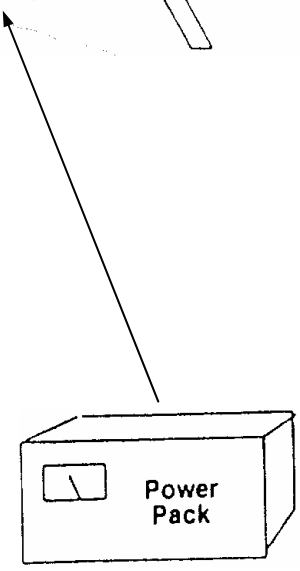
HORIZONTAL MAGNETIC SURFACE

Stand By	**FAST unit**
R & R	**Draw a Diagram of Fire Building in this area.** **Place magnetic identifiers on Fire Building diagram to show how units are deployed.**
Agencies P.D. E.M.S. D.E.P. Electric Gas Telephone Press	

Figure 3
PORTABLE COMMAND POST







Power pack used to recharge battery and for power during extended operations

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix H

REGULATIONS FOR RECALL

RECALL

Appendix H
Regulations Chapter 18 Recall
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18.1 RECALL PROCEDURE

18.1.1 In the event it becomes necessary to augment temporarily the numerical strength of manpower on duty within the Department during actual or potential emergency conditions, the signal 65-2 will be transmitted under jurisdiction and authorization of the Fire Commissioner.

18.1.2 Upon receipt of signal 65-2 transmitted to implement recall, chief and company officers shall follow instructions transmitted. Depending upon the area affected and the degree of necessity, the orders relative to scope of the recall will be announced over the Department radio, voice alarm, and by teleprinter messages.

18.1.3 Recall may be total (city-wide) or partial (confined to one or more boroughs). It may affect all units or selected units, such as engine companies only. The time frame may run from continuous duty to specific tours or hours.

18.1.4 Cancellation of recall will be by the 65-2 signal as above, under authority of the Fire Commissioner.

18.2 MEMBERS SUBJECT TO RECALL

18.2.1 During the period recall is in effect, all members, with exceptions noted below, shall be subject to recall duty in accordance with 65-2 instructions and provisions of this chapter.

A. Exemptions:
1. Members assigned to medical leave, limited service or light duty.
2. Members on vacation, military, death, special, or emergency leaves.

B. Conditional: (subject to discretion and as directed by the Fire Commissioner prior or subsequent to recall).
1. Pilots, marine engineers, assistant marine engineer, wipers.
2. Officers, members, firefighters 6th grade assigned to the Bureau of Training (including members who are regularly assigned to units but currently attending such courses as officer training, chauffeur training, etc.).
3. Full duty member - Detailed to other than fire duty.

18.2.2 During periods of limited recall ordered under directions attendant upon signal 65-2, members designated, whether by area, group assignment, rank, grade, or classification shall be retained or recalled and perform tours of duty as directed by the Fire Commissioner.

The exemptions and conditional provisions of Section 18.2.1 shall apply unless otherwise specified.

18.2.3 Upon receipt of recall signal, all units out of quarters in affected borough, other than those units operating at a fire or emergency, shall return to quarters immediately. Relocated and interchanged units shall be guided by instructions received from dispatchers.

18.3 NOTIFICATION OF MEMBERS

18.3.1 In those instances requiring a citywide recall, it shall be the responsibility of each member to monitor the news media and report for duty as required.

In limited recall situations where media coverage may be limited, officers on duty shall immediately notify affected off duty members as necessary.

18.3.2 Commanding officers shall, in order to insure prompt telephone notification of off duty members, maintain a current and accurate personnel record of emergency telephone numbers in the office record journal, as outlined in section 16.1.1 of the Regulations.

18.3.3 When necessary, notice by telephone shall be direct to affected members. If this is not possible, information shall be conveyed to a person of suitable age and discretion at the members residence or emergency telephone number for prompt relay to the member. In either case, officers on duty shall record in the company journal the time of telephone notification and name of the person notified.

18.3.4 Officers shall endeavor to have members notified of recall information by use of telephones not connected to Bureau of Fire Communications. If this method proves impracticable Department telephones may be used.

18.3.5 Accuracy of emergency telephone information in the personnel record of office record journal shall be the responsibility of individual members. Changes shall be promptly reported to the officer on duty, who shall immediately alter the record.

18.3.6 Members temporarily detailed to other units, affected by the transmission of a recall signal, shall report to such detailed units.

18.4 BUREAU OF TRAINING

18.4.1 Officers, members, (staff or members currently assigned to a training course), and firefighters 6th grade in training shall be subject to recall only under specific orders of the Fire Commissioner. Classes, unless otherwise directed, shall remain in session.

18.4.2 Members regularly assigned to operational units who are currently attending courses conducted by the Bureau of Training, under Departmental orders, when notified either by assigned unit or by an officer of the Bureau of Training that conditional recall exemption has been waived, shall comply with recall provisions presently in effect by reporting without delay, to assigned units.

18.4.3 Sixth grade firefighters enrolled in classes at the Bureau of Training shall, when utilization of their services during recall or other emergency has been directed by the Fire Commissioner, operate under orders and close supervision of officers of the Bureau of Training.

Mobilization, supervision and transportation of sixth grade firefighters to the scene of emergency operations shall be activated in accordance with planned arrangements and schedules devised by the chief of the Bureau of Training.

18.4.4 Officers assigned under recall to supervise sixth grade firefighters responding to emergency conditions, shall report in to Field Headquarters, or to the superior fire officer on duty in the area when Field Headquarters has not been established.

18.5 SPECIAL OPERATING PROCEDURE

18.5.1 After transmission of recall notification the following special regulations shall be effective:

A. When two chief officers are on duty in a division or a battalion, only one shall respond to an assigned alarm. The second chief shall operate according to instructions received from the citywide tour commander.

B. Special Units shall respond according to the Communications Manual, unless otherwise specified.

C. Deputy chiefs shall arrange to place spare apparatus in service. They shall cooperate with battalion chiefs in providing details of members to divide units and place the maximum number of companies in service. Dispatchers shall be advised when such companies are placed in service.

18.6 RELEASE OF MEMBERS

18.6.1 Release of members recalled or retained on duty under instructions attendant upon signal 65-2 may be accomplished, at the direction of the Fire Commissioner, by repetition of the signal 65-2 followed by orders specifying the hour and method for terminating emergency duties.

18.7 REPORTS

18.7.1 Commanding officers shall forward reports 24 hours after transmission of a recall signal recording the time each member reported for duty in response to such signal.

Appendix I

FIRE FIGHTING PROCEDURES HIGH RISE OFFICE BUILDINGS

HIGH-RISE OFFICE BUILDINGS

Appendix I
Fire Fighting Procedure High Rise Office Buildings
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GLOSSARY

Access stairs A stairway, usually open, serving a number of floors of a common tenant. Also known as convenience stairs.

Air diffusers The air supply outlets of the heating, ventilation and air conditioning system (HVAC) into the conditioned space.

Attack stairway A fire stair being used by the Fire Department to gain access to the fire area, where the door between the stairway and the fire area is being maintained in an open position.

Blind shaft elevators Elevators serving the upper areas of a building in a shaft that is not equipped with hoistway doors on the lower floors.

Building evacuation supervisor When the fire safety director is not present in a class "E" office building occupied by less than 100 people above or below the street floor or by less than 500 people in the entire building, an employee trained by the fire safety director will man the fire command station and execute the fire safety plan.

Churning A condition in a centrifugal pump in which the impeller is rotating but no water is being discharged.

Core type building A building in which the elevators, stairway and building support systems are grouped together in one area of the building. This area could be in the center of the building as in a center core building or on one of the sides of the building as in a side core building.

Compartmentation The subdividing of floor areas by fire resistive separations into smaller spaces or compartments.

Curtain wall A non-bearing wall, built between piers or columns for the enclosure of the structure, but not supported at each story.

Damper A device to seal off or to control air flow in a HVAC system.

Diffusers See air diffusers.

ECC	Engine Company Chauffeur. A Fire Department member trained and qualified to operate Fire Department pumpers.
Elevator control panel	A visual display unit located in the lobby to indicate the status and location of all elevator cars and necessary controls for the operation of the cars.
Elevator door vane	The connection between the elevator car doors and the hoistway doors. It allows the elevator car doors to drive the hoistway doors.
Elevator machinery room	The area where the equipment is located that raises and lowers the elevator car. It can be at the top or bottom of the elevator shaft. In High-Rise buildings it is usually found at the top of the shaft.
Evacuation stairway	fire tower or a fire stairs that is remote from the fire area and used for the evacuation of the building occupants. A fire tower is the preferred evacuation stairs.
Fire dampers	A damper used to restrict the passage of heat.
Fire partition	A rated vertical unit or assembly of materials that separate one space from another within any story of a building.
Fire safety director	A designated employee holding a certificate of fitness from the Fire Department qualifying him to perform the duties as required.
Fire shutter, (reversible)	A fire damper that can be controlled from a remote location.
Fire tower	An enclosed stairway connected at each story by an outside balcony or fire proof vestibule vented to the outside.
Fusible link	A device designed to be actuated by an abnormal rise in temperature.
Hard wire communications	A system of communications in which wiring physically connects both lobby command post and other areas within the building. Viz.: Points of transmission and reception.
High-Rise communications kit	Handie-Talkie accessories designed to improve the performance of Fire Department Handie-Talkies when used within High-Rise buildings. (See AUC 179R addendum No. 2)

Key (1620) An official Fire Department alarm box key.

Key (2642) A standard key used by the elevator industry.

Locked door fail safe system A system where the lock mechanism is controlled electrically from a remote location.

Mechanical control center A location within a building where equipment is located for the monitoring of the building support systems. It has limited ability to control some of the building support systems. It may or may not be located on the same floor as the mechanical equipment rooms (MER).

Mixing dampers Dampers in the HVAC system which control the mixing of the return air and outside air.

Plenum An air compartment or chamber to which one or more ducts are connected and which form a part of an air distribution system. In High-Rise buildings the space between the suspended ceiling and the under side of the floor above is used as a plenum for the collection of the return air.

"Q" decking A type of composite floor construction in which corrugated steel is used to support the concrete floor. (See Fig. 2-1)

Reversible fire shutters See Fire Shutter (reversible).

Safety fire shutters See Fire Shutter (reversible).

Safety edge The leading edge of an elevator car door which causes the door to reverse its direction when it encounters an obstruction.

Set backs The area formed when the floor area of a building is reduced thus requiring the exterior wall of a building to be recessed.

Scissor stairs Two stairs constructed side by side in the core of a building in which their doors alternate the point of exit to opposite sides of the core.

Size-up An estimate of the conditions and problems of a fire or emergency situation by the officer in command.

Sky lobby	An elevator terminal point on an upper floor of a building where passengers can change from one bank of elevators to another.
Smoke ejector	A fan used by the Fire Department to move smoke or air.
Sound powered phone system	A portable hardwire telephone system powered by voice sound.
Staging area	An area established on a floor below the operations post to provide logistical support to the operations post.
Search and evacuation post	A position established above the fire operations to control and coordinate all operations in that area.
Standpipe kit	A collection of tools used by an engine company to effectively operate a hose line from a standpipe system.
Thermostatic detector	A device to detect an increase in temperature.
Variation	Permission given by the Department of Buildings and/or Board of Standards and Appeal to construct a building in variation with the existing Building Code.

1. INTRODUCTION

1.1 PURPOSE

The purposes of this book are:

1.1.1 To describe High-Rise Class "E" office buildings. Over 800 of these structures can be found in New York City.

1.1.2 To point out the problems and features of such buildings with regard to fire.

1.1.3 To establish methods of operating at fires in such buildings, and recommend precautions that should be taken.

1.2 TYPES OF BUILDINGS

1.2.1 The types of buildings included in this book are:

A. High-Rise Class "E" office buildings built before 1945.

B. High-Rise Class "E" office buildings built between 1945 and 1 968.

C. High-Rise Class "E" office buildings built after 1968.

Note: Many of these buildings are 200' x 400' in area with up to six stairways especially on the lower floors and with three or more stairways on the upper floors. However, others have only two stairshafts from lobby to roof with consequent reduction in our mobility and tactical flexibility.

Therefore, to permit an organized approach and deployment of our units this Bulletin is based upon a serious fire on the upper floors of a two-stairway office tower.

1. Because of the variation in construction techniques and the complexity of the High-Rise class "E" office buildings, the procedures outlined in this bulletin must be general in character and must differ substantially from the "Ladders 3" approach used at multiple dwelling fires.
2. In addition, the multitude of fire problems in these structures occupied with the human factor, i.e.; thousands of occupants on upper floors, severely limit the resources available on the first. alarm. As a result, new signals and response patterns will be introduced which demand all units operate in a controlled and coordinated manner.
3. As described in the operational Sections this article's aim is to establish critical priorities and assign chief officers and/or company units, not individual members or teams of members, to solve these problems.

2. DESCRIPTION OF HIGH-RISE CLASS "E" OFFICE BUILDINGS

2.1 GENERAL DESCRIPTION

2.1.1 100 feet or more in height.

2.1.2 Vary in area from 2,000 square feet to over 300,000 square feet.

2.1.3 Class 1 non-combustible.

2.1.4 Buildings shall be classified in the Class "E" occupancy group when they are primarily occupied for transacting business; for rendering professional services that may incidentally involve the storage of limited quantities of stocks of goods for office use or purposes. Buildings and spaces used for providing public and civic services shall also be classified in this group.

Examples are:

A. Office spaces

B. Showrooms

C. Banks

D. Telephone exchanges

E. Civic administration

F. Assembly occupancies such as restaurants, cafeterias, etc., also may be found in office buildings.

2.2 CLASS "E" HIGH-RISE OFFICE BUILDINGS BUILT BEFORE 1945

2.2.1 The construction techniques used in these buildings resulted in a "heavy-weight" building, usually weighing about 20 to 23 pounds per cubic foot.

2.2.3 Structural steel components were encased in concrete.

2.2.4 Exterior walls were of masonry construction.

2.2.5 Exterior walls were substantially tied to all floors.

2.2.6 Plenum type ceilings are generally not found in these buildings.

2.2.7 Normally steam heated.

2.2.8 Usually not centrally air conditioned.

2.2.9 Exterior windows were openable.

2.2.10 All buildings erected between 1938 and 1968 were required to have a fire tower. Some built prior to 1938 have fire towers.

2.2.11 Floors were constructed of reinforced concrete.

2.2.12 Core construction techniques were not used.

2.3 CLASS "E" HIGH-RISE BUILDINGS BUILT BETWEEN 1945 AND 1968.

2.3.1 The construction techniques used resulted in a "medium-weight" building, usually weighing between 10 and 20 pounds per cubic foot.

2.3.2 Fire towers were required in all of these buildings

2.3.3 The characteristics of these buildings are a mix of the pre- 1945 buildings and the post 1968 buildings. These buildings were required to conform to the 1938 Building Code but because of the numerous variances granted they used many of the construction techniques of the post 1968 buildings.

2.4 CLASS "E" HIGH-RISE OFFICE BUILDINGS BUILT AFTER 1968

2.4.1 The construction techniques used in these buildings resulted in a "lightweight" building, usually weighing about 8 to 1 0 pounds per cubic foot.

2.4.2 They were constructed with a lack of compartmentation.

2.4.3 The protection of the structural steel component is usually done by spraying on a fireproofing material.

2.4.4 Exterior walls are curtain walls constructed of a combination of glass and metal.

2.4.5 The method of securing the exterior curtain walls leaves a space of 6 to 12 inches which requires additional fire stopping.

2.4.6 The ceiling plenums of these buildings are extensive and lack fire stopping. they are used to return the air to the air-conditioning system and for electrical, communications and other building support equipment.

2.4.7 They are usually heated by the heating, ventilating, and air-conditioning system (HVAC).

2.4.8 HVAC systems are usually multi-floor systems.

2.4.9 Exterior windows are usually not openable.

2.4.10 Fire towers are not required.

2.4.11 Floors are light in weight usually consisting of lightweight concrete, "Q decking", etc. [See Fig. 2-1]

2.4.12 Core construction techniques are used extensively.

3. DELETED

4. HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM (HVAC)

4.1 INTRODUCTION

4.1.1 The strategic objectives of good HVAC management are to use the HVAC system to limit the spread of fire and to control the movement of smoke within the building. Also, this system provides the greatest assistance to Fire Department members who are being deployed to control the fire, and who are conducting the primary search for any trapped occupants.

4.1.2 To utilize the HVAC system to its full potential during a fire in a High-Rise office building, the officer in command of the fire must know how the system functions and have a strategic plan for its use.

4.2 DESCRIPTION OF HVAC SYSTEMS

4.2.1 The HVAC systems found in High-Rise office buildings fall into two general categories:

A. Central air conditioning systems, in which the processing equipment supplies air to more than one floor.

B. Non-central air conditioning systems that serve only the floor on which the processing equipment is located.

Note: Because central air conditioning systems are the most commonly found in High-Rise office buildings and create the most problems during a fire, the main emphasis of this section will be central air conditioning systems.

4.2.2 The HVAC system may be divided into three sub-systems:

A. Processing equipment.

B. Supply of processed air to the floors of the building.

C. Return of the air from the floors to be reprocessed.

4.2.3 The processing of the air is usually done on the floors of the building where the mechanical equipment rooms (MER) are located.

4.2.4 The following equipment necessary for the processing of the air will be found on the MER floor: [see Fig. 4-1]

A. Outside air supply dampers.

B. Equipment for the filtering, heating, cooling and humidity control of the air.

C. Supply air fans.

D. Smoke and heat detectors.

E. Duct work to the supply air shaft.

F. Duct work from the return air shaft.

G. Return air fans.

H. Exhaust dampers.

I. Mixing dampers.

5.2 PUMP PRESSURES

5.2.1 To simplify computing pump pressure when supplying a standpipe system, a chart has been formulated. These calculations are based on nozzle pressure, friction loss of three lengths of 2-1/2" hose, head loss, system friction loss and friction loss of two lengths of 3-1/2" hose supplying the Siamese.

5.2.2 Chart.

RECOMMENDED PUMP PRESSURES

FIRE	FLOOR(S)	CONTROLLING NOZZLE	FOG NOZZLE
Floors	1 - 10	150 psi	200 psi
Floors	11 - 20	200 psi	250 psi
Floors	21 - 30	250 psi	300 psi
Floors	31 - 40	300 psi	350 psi
Floors	41 - 50	350 psi	400 psi
Floors	51 - 60	400 psi	450 psi
Floors	61 - 70	450 psi	500 psi
Floors	71 - 80	500 psi	550 psi
Floors	81 - 90	550 psi	600 psi
Floors	91 - 100	600 psi	650 psi
Floors	101 - 110	650 psi	700 psi

5.2.3 If the height of the fire floor requires pressure in excess of 250 psi the officer in charge can order higher pressures at the pumper if the following precautions are followed:

A. All civilian and Fire Department personnel are removed from a zone 50 feet on each side of the hose line supplying the siamese. 3" special high-pressure hose must be used.

B. Warning tapes, stanchions or utility ropes are utilized to maintain this area clear.

C. A Battalion Chief is designated to control this pumping operation.

D. An audible alert be used to inform civilians and personnel on the scene. (Public address systems on apparatus may be utilized)

E. Supply line to the siamese or standpipe outlet valve must be secured by utility rope to a substantial object.

F. Only special high-pressure fittings may be used. They are painted white and are noticeably heavier than standard fittings.

G. Maintain safety zones of at least 50' around a working pumper (high-pressure) in all directions.

H. Supply lines must be connected to the pumper on the side opposite the control panel.

I. Unused gated inlets and outlets must be closed and all caps secured to the pumper.

J. Each pumper being utilized at pressures in excess of 250 psi must be controlled by the E.C.C., assisted by an E.C.C. from a non-operating pumper.(One man to operate pumper and one man to maintain radio communications)

K. Command post to establish radio communications with all units involved in high-pressure pumping operation.

L. During high-pressure pumping, members must not utilize stairways as staging or rest areas. Utilize minimum amount of personnel in stairways served by standpipes.

M. The Chief in Command must designate a unit(s), to control and mark off safety zones.

Note: On the scene, the Safety Operating Battalion may be utilized to control this operation.

5.2.4 When the fire is above the 50th floor, or the building water supply is unsatisfactory, it may be necessary to use the third stage of the high-pressure pumper. Only the Chief in Charge of the fire may order this use. Chauffeurs of high pressure pumpers must ensure that tether security ropes are in place prior to activating the third (3rd) stage of the pump.

5.3 OPERATING PROCEDURES

5.3.1 Pump pressure must be increased slowly and floor outlet valves opened slowly to avoid pressure surges at the nozzle.

5.3.2 Member operating floor outlet valve must open it sufficiently to provide the required nozzle pressure as determined by the officer supervising the line.

5.4 MANUALLY OPERATED BUILDING FIRE PUMPS

5.4.1 Introduction

A. The purpose of this section is to familiarize members with manually operated fire pumps.

B. The 1968 Building code requires a manual fire pump to supplement the standpipe system in buildings over 300 feet high. The 1938 Building Code requires a manual fire pump in buildings over 250 high.

C. Many times there are manual fire pumps in other than High-Rise buildings. The same guidelines should be used in all buildings where building fire pumps exist.

D. It always has been the responsibility of building engineers to start the building fire pumps and this section in no way releases them from this assignment. We have found, however, that some engineers have been assigned to other duties when a fire starts. There is also the possibility that the building engineer might not be on duty at the time of the fire.

5.4.2 Pump room location.

A. Follow signs or directions to the pump room which is normally located on the lowest floor (cellar or sub-cellar-cellar).

B. Locate the pump and note the gauges on (C) inlet and (D) discharge lines. [see Figs. 5-1, 5-2 and 5-3]

C. Locate the bypass valve (B) on the discharge side of the fire pump. The discharge side can be readily identified by examining the gauges. The discharge gauge is calibrated for higher pressures than the inlet gauge.

D. The bypass valve should be in the closed position (stem in). Some engineers keep them open for test purposes, so they must be checked by the ECC assigned to operate the pumps. If they are found to be open, they should be closed by turning in a clockwise direction.

E. Some systems are quite complex and the bypass valve is not readily discernible . If such a situation is present, it is permissible to start pump as ordered without checking bypass valve. Notify the engineer upon his arrival of this and any other actions taken. The efficiency of the pump will be affected if the bypass is open. A loss of 25 % can be expected in an 8" riser, and a loss of 45% can be expected in a 6" riser, with the bypass open.

F. Locate the Fire Pump Control cabinet [see Figs. 5-4 and 5-5] in the vicinity of the pump and read the instruction plaque. (7)

5.4.3 Description of control cabinet.

A. The control cabinet for a 750 gallon fire pump will be in the shape of a large cube. It varies from 6' x 6' x 6' to as large as 8' x 8' x 8' in the older models. The front of the cabinet will be the control panel. [see Figs. 5-4 and 5-5]

5.4.4 Four step procedure for starting of fire pumps, using the control panel.

OPERATION	LOCATION
A. Close knife switch (1) to on position. [Fig. 5-4 or 5-5]	1. On front panel (or) 2. Inside panel door
B. Close circuit breaker(s) (2) & power "on" light will glow.	1. On front panel (or) 2. Inside panel door
C. Push starting button (3) & pump "on" light will glow. [Fig. 5-4 or 5-5]	1. On front panel (or) 2. Inside panel door (or) 3. Adjacent to panel door
D. Move selector lever (4) to desired position increasing pump speed and thereby increasing pressure.	1. On front panel (or) 2. Inside panel door (or) 3. On outside cabinet on either side of front panel

5.4.5 The fire pumps should now be operating, if they have failed to start, the emergency power lever located at the panel shall be used. Push or pull to "on" position (5). [see Fig. 5-4 or 5-5]

5.4.6 Additional duties of the member assigned will include:

A. Contact be maintained with fire command station, via

1. Handie-talkies (or)

2. Fire Command station phone located in pump room.

B. Checking of the pressure gauge on the discharge side of the fire pump located near the riser. This is to insure that the pressures called for are being maintained. The following chart will help determine the proper setting of the speed selector lever. The building management is encouraged to provide just such a chart. The chart they supply should be located at the control panel and may vary slightly depending upon efficiency of the pump.

5.4.7 Recommended Pump Pressure

FIRE FLOORS	CONTROLLING NOZZLE	FOG NOZZLE
Floors 1 to 10	150 psi	200 psi
Floors 10 to 20	200 psi	250 psi
Floors 20 to 30	250 psi	300 psi
Floors 30 to 40	300 psi	350 psi
Floors 40 to 50	350 psi	400 psi

5.4.8 Building fire pump data.

A. The engineers should be used if available but they may not have any knowledge of the pressures required to supply hose lines on upper floors. ECC shall be assigned to either assist the engineer, or to start and operate the building fire pumps.

B. Building fire pumps are usually located in the cellar or sub-cellar and fire lines connected to them should be painted red.

C. Pump capacity is usually 750 gpm Most High-Rise buildings have two pumps side by side which are connected in the parallel position.

D. The operation of these pumps is usually standard from building to building even though the physical layout may differ.

E. Some buildings have a combination standpipe/sprinkler system with the siamese connected to both systems. The same starting procedures will apply in these buildings. The usual arrangement for the fire pumps is that one will be automatic and one manual. The automatic fire pumps may be of smaller capacity. (250 gpm or 500 gpm).

F. When a building is equipped with two manual fire pumps, as is the case in most High-Rise buildings, each pump will have its own control panel. Both pumps shall be started and used.

G. Since fire pumps are connected in parallel position, it is necessary to have both pumps operating at or near the same pressures. Should one manual pump be operated at a pressure far in excess of the other, it could partially overcome the check valve making the second pump less efficient. A visual check should be made of the discharge gauges of both pumps. When both are operating correctly, the pressures should be equal or nearly so.

H. Where one gauge reading is considerably lower than the other, the pressure can be increased on the less efficient pump by moving the pump position lever to a higher position.

I. When the engineer of a building is present, this should be left to him to adjust since he will be familiar with the system's maintenance history and prior malfunctions.

J. Near each fire pump is a standpipe phone providing direct communication with the lobby command post.

K. When the command to shut down the building fire pumps is received, and the engineer in charge is not available, the pumps are deactivated by reversing the starting procedure.

1. Return pump position lever to lowest speed.
2. Push "off" button.
3. Open circuit breakers.
4. Open knife switch-(off position).
5. Advise the lobby command post that the pumps have been deactivated.

5.5 OTHER CONSIDERATIONS

5.5.1 The building fire pumps shall be capable of delivering their rated capacity at a pressure of 50 psi at the highest floor hose outlet.

5.5.2 A relief valve is required at the fire pump limiting the pressure to 15 psi above that required to deliver its rated capacity at 50 psi to the highest floor outlet.

5.5.3 Because of the above restrictions, the building fire pump may not be capable of supplying adequate nozzle pressure to hose lines at the upper floors. The primary water supply to the standpipe system in many buildings is a gravity tank. In many instances, there will be inadequate head pressures supplied to the uppermost floor-hose outlets supplied by that gravity tank. For these reasons, the primary water supply for Firefighting in most operations shall be the Fire Department pumpers.

5.5.4 When the building fire pumps and Fire Department pumpers are being used to supply the standpipe system, both systems must be monitored to prevent overheating caused by churning.

5.5.5 The high pressures required to supply water to the upper floors of a High-Rise building limit the amount of water that a Fire Department pumper can supply. A good “rule of thumb" is to have a separate pumper supply the standpipe system for each hand line in operation.

6 OPERATIONS OF FIRST ALARM BATTALION CHIEF

6.1 STRATEGIC OPERATING PLAN

6.1.1 The following is a basic strategic operating plan for use at major High-Rise fires. (Listed in order of importance)

A. Determine specific fire floor (if possible) or the floors on which smoke is reported from any information that is available to you in the building lobby.

1. Frequently (especially during off business hours) specific fire floor information will not be available other than a report of smoke on numerous floors (e.g. 20th to 35th floors).

B. Verify fire floor. Sift information received from responsible occupant/building management personnel and/or first arriving ladder company.

1. We must determine the fire floor location as rapidly as possible. All future actions hinge on this vital piece of information.

C. Simultaneously, or as soon as possible, begin the process of controlling evacuation.

1. Occupants of numerous floors may have self-initiated evacuation causing almost a mob scene or near panic in stair shafts or building lobby.
2. Due to large floor areas or maze like corridors, occupants on the fire floor may be unaware of the fire until it is too late to evacuate. Search of large areas will be required.
3. Search and evacuation of the floor above the fire will also be required as soon as possible.

D. Gain control of the building systems.

1. Elevators.
2. HVAC.
3. Communications.
4. Fire pumps.

E. Confine and extinguish the fire.

1. Experience indicates any serious fire will require a large commitment of units and equipment because of extensive logistic problems and a need for frequent relief of members.

F. Battalion Chief assignments and duties at High-Rise fires are pre-determined only for the Lobby and Operations Posts. Battalion Chief operations after these positions are covered shall be designated by the Incident Commander. The Search and Evacuation, Staging area, and Attack positions shall be assigned as conditions dictate. Section 6.5.4 defines fire situations where the services of "Attack Chief" shall be utilized.

6.2 PROCEDURES TO IMPLEMENT THE STRATEGIC OPERATING PLAN

6.2.1 For the first arriving battalion chief to achieve the above outlined strategic operating plan, the prime position is at the lobby command post. From this Post he will have control over all building systems through the fire safety director or his surrogate. He will receive first hand information about other problems that may develop on floors above the fire through the building communications networks. He will have liaison with the Police Department for control of the lobby and the streets in the vicinity of the fire building, Under the direct control of an alert and knowledgeable battalion chief, the lobby position is of prime importance. To provide continuity of operations, it is essential that the first arriving battalion chief remain at the lobby command post to assist the chief in charge of operations. He shall remain at the lobby command post until his services are no longer deemed necessary.

6.2.2 The first arriving battalion chief will be required to make an initial size up to determine the adequacy of the response and the need for additional response.

A. A 10-76 signal shall be transmitted when a report of fire is confirmed. Any fire in a High-Rise office building which requires the stretching and operating of one hose line will necessitate the use of "All Hands."

B. A second alarm is warranted for any visible fire or smoke emanating through the exterior skin of the building or when a serious fire has been verified.

C. Because of the large number of occupants in High-Rise office buildings, even fires of a minor nature may require additional units to prevent unnecessary evacuation and panic.

6.2.3 The first arriving battalion chief shall establish liaison with the fire safety director if present, or his surrogate to determine the following:

A. Has the fire floor definitely been determined?

B. What is the extent of the evacuation that has been implemented?

C. Have there been any reports of severe life hazards?

D. What is the status of the elevators and the HVAC system?

E. Are there any access stairs in the vicinity of the reported fire floor?

F. What communications have been established between the fire floor and the lobby command post?

G. What communications have been established between the lobby command post and the occupants of the building?

6.2.4 The battalion chief should arrange for the fire safety director or the evacuation supervisor to make an announcement over the PA system or the intercom system. "This is your Fire Safety Director, Dr. John Doe. The New York City Fire Department has just arrived to extinguish a fire on the floor. As they obtain information, we will pass it along to you. If your assistance is required, I will make such an announcement. In the meantime, please remain calm at your place of employment."

6.2.5 The fire safety director MUST be informed to remain in the lobby where his assistance will be available at any time.

6.2.6 Obtain copies of the floor plan of the fire floor from the fire safety director.

6.2.7 As soon as possible, the first arriving battalion chief shall start obtaining the additional information required by the High-Rise check list. [see Fig. 6-11]

6.3 TACTICAL PLAN

6.3.1 To achieve the basic strategic plan, the first arriving battalion chief shall use the following tactics:

A. Contact any units that are on the scene before his arrival, to ascertain their location, fire conditions, and the operations they have implemented. This information may be obtained from the Fire Department member who is manning the command post pending the arrival of the battalion chief.

B. Deleted

C. The placement of the 10-76 assignment shall be as follows:

1. The first and second arriving engine companies shall be teamed to stretch and operate the first line.
2. The third and fourth arriving engine companies shall be used to stretch and operate the second line.
3. The first arriving ladder company shall be assigned to search and evacuate the fire floor.
4. The second arriving ladder company shall be assigned to augment the search and evacuation of the fire floor.
5. The third arriving ladder company shall be assigned to search and evacuate the floor above the fire.
6. The fourth arriving ladder company shall be assigned similarly, to operate on the upper floors.
7. The rescue company shall be used to perform special tasks as determined by the officer in command of the fire.
8. The second arriving battalion chief shall be assigned to establish and operate the operations post. (See Section 6.5)

6.4 TACTICAL CONSIDERATIONS

6.4.1 A prime decision that the first arriving battalion chief must make is the placement of the first line. The following conditions must be considered:

A. To select the stairway from which to operate the first line (attack stairway), evaluate information received form operating units as to the location of the fire in relation to the stairways and the standpipe system.

B. The number of stairways serving the fire floor.

C. The stair or stairways being used by the occupants of the building.

1. A line shall not be operated from a stairway until it has been cleared of building occupants.

2. A stairway shall be selected for evacuation of building occupants (evacuation stairway) preferably a fire tower if available.

3. The specific fire floor and the floor above are initially all that are required to be evacuated. However, occupants of many other floors may self-initiate evacuation utilizing any or all stairways until instructed otherwise.

6.4.2 After the placement of the first line has been determined, the first arriving battalion chief then must consider the need for and the placement of the second line. The items to be considered in making this decision are:

A. Information received from operating units.

B. Number of stairways available to the fire area.

C. Type of construction:

1. center-core construction.

2. side-core construction.

3. non-core construction.

D. Location of the stairway with regard to the core.

E. Has the first line been stretched to the most advantageous position for attacking fire?

F. Has search and evacuation of the fire floor been completed.

6.4.3 Considering all the above items the placement of the second line may be used to:

A. Reinforce the position of the first line.

B. Protect the position of the first line.

C. Protect the search and evacuation of the fire floor.

D. Contain and confine fire spread and/or prevent fire from wrapping around the core and endangering operation of the first line.

6.4.4 Is this fire within the reach of outside streams?

6.4.5 Are there any set-backs in the vicinity of the fire floor, which may be used for:

A. Ventilation?
B. Attack on the fire?
C. Search and evacuation?

6.4.6 Are there any horizontal exits to other buildings near the fire floor, which must be protected or may be used advantageously in the operation?

6.4.7 The time of day must be considered as this will affect:

A. The occupancy load.
B. The status of the buildings systems.
C. The response time of the units.

6.4.8 Ventilation by the removal of windows on the fire floor or other floors is not an initial consideration. It should be delayed until an evaluation can be made of its effect on air movement in the fire area and throughout the building. Before ventilation by the removal of windows is undertaken, safety precautions have to be taken in the area that will be affected by falling glass shards.

6.5 OPERATIONS POST

6.5.1 The second arriving battalion chief shall establish and man the operations post.

6.5.2 Establishment of the operations post.

A. It shall be established on the first floor below the fire, where conditions permit.
B. The location of the operations post shall insure reliable communications with the operating units and the lobby command post.
C. The operations post shall be equipped with the following:
    1. High-Rise communications kit.
    2. Resuscitator.
    3. Masks for all personnel required for the operations of this post.
    4. Copy of the floor plan.
    5. Operations post log. [see Fig. 6-2]

6.5.3 The chief in charge of the operations post shall be responsible for:

A. Control and coordination of the units operating on the fire floor and the floor above.

B. All communications between the operations post and the units operating within his sector.

C. All communications between the operations post and the lobby command post.

D. The implementation of the tactical procedures as received from the lobby command post.

E. Advising the lobby command post of conditions, problems and the need for additional units.

F. Consulting with the lobby command post as to additional tactical procedures required.

G. Communications with the staging area once it has been established.

H. Keeping in reserve an adequate number of units at the operations post for the orderly relief of unit operating on the fire floor and the floor above.

6.5.4 When conditions require, the third and fourth arriving battalion chief will operate under the direction of the chief in charge of the Operations Post. The Attack Chief shall direct unit attacks on the fire floor, and communicate progress reports to the Operations Post. Attack Chief and shall be assigned as conditions dictate.

7. COMMAND POST PROCEDURES

7.1 INTRODUCTION

7.1.1 Fires in High-Rise office buildings place unique demands upon the fire service. The large floor areas, the height of the buildings, the large number of occupants and the complex building support systems, all require that the fire service establish procedures to command, control and coordinate our operations at fires within these buildings.

7.2 COMMUNICATIONS

7.2.1 The command, control and coordination of fire department operations at fires in High-Rise office buildings require a well defined and structured communications network, composed of the following elements: [see Fig. 7-1]

A. Equipment:

1. Fire Department Handie-Talkies.
2. High-Rise communications kits.
3. Fire Department radio.
4. Hard wire communication as follows:
   a. Class "E" system.
   b. Standpipe telephones.
   c. In-house telephones.
   d. Outside telephones.
   e. Sound-powered phone systems.
5. Building Handie-Talkie radio network.

Note: At the present time extensive experimentation is being conducted with a Cross Band Repeater Radio System (WNYF-1st Issue 1981) and Sound Powered Phone Systems which will substantially alter our High-Rise communication procedures.

B. The lobby command post will be the center of all communications, and shall establish the following communications network:

1. Department radio and hard wire with the Fire Department dispatcher.
2. Handie-Talkie communications on the command channel with the operations post, staging areas and search and evacuation post. Hard wire communications also shall be established.
3. The chief in charge of the lobby command post shall operate on the command channel. His aide shall operate on and monitor the primary tactical channel.
4. Further information on Lobby Command Post in contained in Section 7.3.

C. The chief-in-charge of the operations post shall establish the following communications network:

1. Handie-Talkie communications on the primary tactical channel with the units under his command. When the operations post is established, units under its command shall not communicate with the lobby command post unless urgent.
2. Handie-Talkie communications with the lobby command post on the command channel. Hard wire communications also shall be established.
3. Handie-Talkie communication between the operations post and the staging area shall be conducted on the command channel.
4. The chief-in-charge of the operations post shall operate on the primary tactical channel. His aide shall operate on the command channel.
5. Further information on Operational Post is contained in Section 7.4.

D. The chief in charge of the search and evacuation post (SAE) shall establish the following communications network:

1. Handie-Talkie communication with the units under his command on the secondary tactical channel. When the SAE post is established, units under its command shall switch to secondary tactical channel and shall not communicate with the lobby command post unless urgent.
2. Handie-Talkie communications with the lobby command post on the command channel. Hard wire communication also shall be established.
3. The chief in charge of the search and evacuation post will operate on the secondary tactical channel. His aide will monitor and operate on the command channel.
4. Further information on Search and Evacuation Post is contained in Section 7.5.

E. The chief in charge of the Staging Area shall establish the following communications network:

1. Handie-Talkie communications with the lobby command post and the operations post on the command channel. Hard wire communications also shall be established with the lobby command post.
2. The chief in charge of the staging area shall operate on the command channel. His aide shall monitor the primary tactical channel.
3. Further information on Staging Area is contained in Section 7.6.

7.2.2 In all communications directed to the lobby command post, the operations post, the search and evacuation post and the staging area, the post designation shall be used rather then the unit designation. Examples:

A. "Operations post to lobby command post
B. "Ladder 8 to operations post."
C. "SAE post to lobby command post."
D. "Lobby command post to staging area."

7.2.3 High-Rise communications kits shall be utilized at lobby command post (2), operations post (1) and staging area (1). [see Figure 7-1]

7.3 LOBBY COMMAND POST

7.3.1 The early establishment of a lobby command post will enable the chief in charge to exert central control over:

A. Evacuation.
B. Building systems.
C. The Fire Department units being deployed to locate, confine and extinguish the fire.

7.3.2 To assist the lobby command post, it may be necessary to establish areas of command as follows:

A. Operations post.
B. Search and evacuation post.
C. Staging area.

7.3.3 Location and description of lobby command post.

A. The lobby command post is established by the arriving units in an area in the building and manned by each succeeding officer in command. From this post operations conducted in the building by Fire Department units are coordinated and controlled. It shall afford the officer in command access to the following:

1. The fire safety director.
2. The fire safety plan.
3. Floor plans.
4. The class "E" communications system.
5. Outside telephone lines.
6. In-house telephone lines if available.
7. Building, elevator and window keys.

B. The lobby command post shall be established at a location that provides the following:

1. Accessibility to incoming units.
2. Control of the elevators.
3. Control of the building fire command station.
4. Facilities for communications with the following:
   a. Dispatchers.
   b. The fire pump room.
   c. The HVAC control center.
   d. The operations post, SAE post and the staging area.
   e. The building occupants.

7.3.4 Manning of the lobby command post.

A. The first arriving officer shall establish the lobby command post. In the event that he leaves the lobby command post before the arrival of a chief officer he shall designate a member to man the lobby command post, preferably the chauffeur of the first arriving ladder company. This member shall then note the units leaving the lobby command post and their destination.

B. The first arriving battalion chief shall assume command of the lobby command post. When he is relieved by the deputy chief, he shall remain at the lobby command post to assist in its operation.

7.3.5 Operations of the lobby command post.

A. The initial operations performed by the first arriving battalion chief are outlined in section 6. To continue the initial operation and to meet the demands of an expanding fire situation the following shall be necessary:

1. Determine the need for additional evacuation and develop a plan for its implementation.
   a. If necessary, establish a search and evacuation post (SAE).
2. Complete the command post check list.
3. Determine the need for additional assistance. (See Section 7.3.6)
4. Implement a plan for the use of the HVAC system.
5. Supply additional units as required to the operations post.
6. Provide additional mask cylinders to the operations post.
7. Account for elevators in all banks.
8. Using the floor plan for the fire floor, plot the location of the fire, the stairway or stairways being used for the attack, the stairway or stairways being used for evacuation and the location of the elevators in relation to the fire.

9. Determine the safety of the service elevator for Fire Department use.
10. Provide fire department personnel to man and operate all elevators being used.
11. Determine the need for and if necessary, establish a staging area.
12. Establish a communications network as outlined in Section 7.2.

Note: The above twelve items will require time, a systematic approach and the assistance of one or more additional chief officers to assure each item is checked and updated as conditions change.

7.3.6 Deleted.

7.3.7 The chief in charge of the lobby command post has the responsibility of supplying logistical support to the operations post, SAE post and the staging area. This support shall consist of manpower and equipment. To accomplish this, he shall do the following:

A. Supply sufficient units to the operations post to support the operations on the fire floor and the floor above.

B. Supply sufficient units to the SAE post to support the operations on the floors above the fire. At least one unit for every five floors to be covered shall be supplied (use more units if necessary).

C. Supply sufficient units to the staging area to enable it to meet the needs of the operations post. At least three engines and two ladder companies shall be at the staging area for immediate support of the operations post.

D. Supply sufficient spare Scott cylinders to the staging area to support operations. A supply of at least 20 spare cylinders shall be maintained at the staging area.

E. Engine companies reporting to the staging area shall bring with them the following equipment unless otherwise directed:

1. A mask for each member.
2. A standpipe kit and a nozzle.
3. A length of hose per member.
4. A spare Scott cylinder for each member.

F. Ladder companies reporting to the staging area shall bring with them the following equipment, unless otherwise directed:

1. A mask for each member.
2. Two sets of forcible entry tools and six foot hooks.
3. Search and utility ropes.
4. A spare Scott cylinder for each member.

G. The High-Rise Unit shall be used by the chief in charge of the lobby command post as a logistical support unit to supply the following:

1. Spare Scott cylinders to the staging area or other areas of the building where required.
2. Special tools and equipment to areas of the building as directed by the chief in charge.

7.3.8 A predesignated unit, that has been trained and equipped to operate as a command post company, shall be utilized to assist the chief in charge of the lobby command post. Its duties shall be as follows:

A. Maintain the command post log. [see Fig. 7-2]

B. Control the operations of all the elevators.

C. Insure the proper manning of all elevators.

D. Any other duties as deemed necessary by the chief in charge of the lobby command post.

7.3.9 Smoke movement in High-Rise buildings and measures to control or remove it are subjects of continuing research. Based on past fire experience and the behavior of normal air movements in tall buildings, a plan for the removal of smoke from the fire building may be developed. Ventilation of High-Rise office buildings shall be supervised and implemented by the chief in charge of the lobby command post. He shall attempt to control the movement of smoke within the building by the following means:

A. The use of the HVAC systems as outlined in Section 4.

B. The use of the Fire Department smoke ejectors (two 9,500 CFM fans) to supply air to the attack stairway three floors below the fire floor. With the doors closed at the top and bottom of the stairway, this will pressurize the stairway in the vicinity of the fire floor, decreasing the stack effect and limiting the spread of smoke throughout the building This will also decrease the effect of drawing the heat and smoke to the stairway causing the member making the attack to be in a high heat area.

C. The smoke ejectors may also be used with the doors open at the top and bottom of the stairway. This will increase the stack effect and assist in the removal of smoke via the stairway,.

D. Vertical ventilation is venting the top and bottom of vertical shafts to the outer air. Vertical ventilation is influenced by the stack effect as follows:

1. Its effect becomes noticeable in buildings over 60 feet, and increases as the building's height increases.
2. Its effect can be either positive or negative.
    a. The positive stack effect is the upward movement of air in a vertical shaft.
    b. The negative stack effect is the downward movement of air in a vertical shaft.

3. Positive stack effect increases as the outside air temperature decreases in relation to the temperature inside the building.

4. Negative stack effect may occur when the outside temperature is greater than the temperature inside the building. Its possibility is greatest when the outside air temperature is above 90 F.

5. Its effect is intensified by the speed and direction of the wind.

6. To obtain the greatest benefit from the stack effect, the doors at the top and bottom of the stairway must be opened when a stairway is used for smoke removal. The street floor near this stairway must also be vented to the outer air.

CAUTION: When using a stairway for smoke removal, an adverse condition could occur on the fire floor, causing heat and flames to be drawn toward the stairway being used. The drawing of heat and smoke toward stairways is especially evident whenever fire towers have been utilized. Due to this experience, fire towers are not recommended for use as fire attack stairs.

E. Horizontal ventilation by the removal or opening of windows is begun, safety precautions shall be taken in the area that will be affected by failing glass shards.

1. Horizontal ventilation should be the last consideration as its effects are least likely to be beneficial.

a. The stack effect of vertical shafts could cause the movement of air into the building and not allow the smoke to escape to the exterior.

7.3.10 The chief in charge of the lobby command post shall control street operations as follows:

A. Establish communication with the police department superior officer on the scene to clear pedestrian and vehicular traffic on all sides of the fire building.

B. Establish exterior inspection by Fire Department personnel of all sides of the fire building to report the following:

1. Fire and smoke conditions.

2. Persons in distress.

3. Any unusual conditions.

7.3.11 Other considerations of the chief in charge of the lobby command post shall include:

A. The early response of the mask service unit.

B. The establishment of a suitable area within the building for the treatment of injured civilian and Fire Department personnel.

C. The response of emergency medical service and Fire Department ambulances.

7.4 OPERATIONS POST

7.4.1 The operations post is an area in the building established by the second arriving battalion chief. Its purpose is the control and coordination of all operations conducted on the fire floor and initially on the floors above.

7.4.2 The operations post shall be established at a location that provides:

A. Proximity to the units operating on the fire floor usually the floor below the fire.

B. Hard wire communications to the lobby command post (Building internal phone system or NYFD Sound Powered Phone System).

C. Reliable Handie-Talkie communications with the units operating under his command.

D. Adequate space for units being held in reserve.

E. Accessibility to units reporting to the operations post.

7.4.3 The operations post shall be equipped with:

A. At least two Handie-Talkies.

B. The High-Rise communications kit.

C. A resuscitator.

D. Masks for all members assigned to the operations post.

E. A copy of the floor plan.

F. The operations post log. [see Fig. 6-2]

7.4.4 The operations post shall be manned as follows:

A. Prior to the arrival of the second battalion chief, the chief in charge of the lobby command post shall designate an officer of one of the first arriving units to coordinate the operations on the fire floor and the floor above.

B. The second arriving battalion chief shall establish and command the operations post, assisted by his aide.

C. The second arriving battalion chief shall remain in command until relieved by the special called deputy chief responding on the 10-76 signal.

D. The deputy chief in charge of the operations post may establish sectors commanded by attack chiefs to coordinate and control units operating on the fire floor and the floor above.

7.4.5 The operations performed by the chief in charge of the operations post are outlined in Section 6.5. In addition, he shall:

A. Insure that the attack stairway has been cleared of building occupants for at least five floors above the fire.

B. Insure that the evacuation stairway is maintained safe for any required evacuation and for use by Fire Department personnel.

C. Review the operations of the first arriving units to determine the need for changes in tactics or procedures.

D. Advise the lobby command post as to the need for and the placement of the second line in accordance with procedures as outlined in section 6,4.2 and 6.4.3.

E. Prior to the establishment of the staging area, advise the lobby command post of the need for:

1. Additional units.
2. An adequate supply of Scott cylinders.
3. Any additional equipment that may be needed.

F. After the establishment of the staging area, obtain the items as listed in "E".

G. Advise the lobby command post of the need for additional evacuation of the floors above the fire.

7.5 SEARCH AND EVACUATION POST (SAE)

7.5.1 The SAE post is established within the building by the third or fourth arriving battalion chief. Its purpose is the control and coordination of all operations conducted above the fire operations (fire operations is defined as the fire floor and one floor above).

7.5.2 The criteria for the location of the SAE post shall be dependent on the following:

A. Fire location and severity

B. Handie-Talkie effectiveness

C. If possible the SAE post shall be established on a floor which is not serviced by the same bank of elevators as the fire floor. [see Fig. 7-3]

Example:

1. If the fire were on a floor serviced by the low rise bank of elevators the SAE post would be established on the 17th floor or at least five floors above the fire floor.
2. If the fire were on a floor serviced by the intermediate bank of elevators the SAE post would be established on the 31st floor or at least five floors above the fire floor.
3. When the fire is on a floor serviced by the High-Rise bank of elevators, the SAE post should be established five floors above the fire.

7.5.3 The SAE post shall be equipped as follows:

1. At least 2 Handie-Talkies.
2. A resuscitator.
3. Masks for all members assigned to the SAE post.
4. A spare Scott cylinder for each member assigned to the SAE post.
5. Floor diagram, Pad and Pen.

7.5.4 The SAE post shall normally be manned by the third or fourth arriving battalion chief and his aide.

7.5.5 The chief in charge of the SAE post shall be responsible for the following:

A. The control and coordination of all units operating above the fire operations area.

B. Obtaining from the lobby command post sufficient units for the operations on the upper floors. All units assigned above the fire operations area shall bring with them a spare Scott cylinder.

C. Preventing unnecessary evacuation and avoiding panic.

D. Controlling necessary evacuation.

1. By the use of the evacuation stairs.
2. By the use of smoke-free blind shaft elevators manned by Fire Department personnel.

E. Preventing the use of the attack stairs for evacuation.

F. Ensuring that all floors above the fire operations area have been searched.

G. Establishing the required communications as outlined in Section 7.2.1 D.

H. Advising the lobby command post of conditions and problems encountered on the upper floors.

7.6 STAGING AREA

7.6.1 The staging area is established within the building by a battalion chief. Its purpose is to provide logistical support to the operations post.

7.6.2 The staging area shall be established at a location:

A. Two floors below the operations post.

B. Where there is adequate space to hold units and equipment in reserve.

C. Where the units have ready access to the operations post.

D. That provides hard wire communications to the lobby command post.

E. That provides reliable Handie-Talkie communications between the staging area and the operations post and the lobby command post.

F. That is accessible to units reporting to it.

7.6.3 The staging area shall be equipped as follows:

A. At least two Handie-Talkies.

B. The High-Rise communications kit.

C. Resuscitator.

D. Staging area log. [see Fig. 7-4]

7.6.4 The staging area shall be manned by a battalion chief and his aide.

7.6.5 The chief in charge of the staging area shall be responsible for the following:

A. Control of all units being held in reserve and those units on R & R.

B. Obtaining from the lobby command post sufficient units to adequately meet the demands of the operations post. At least three engine and two ladder companies shall be maintained in reserve at the staging area.

C. Maintaining communications with the operations post on the command channel.

D. Maintaining at least 20 spare Scott cylinders.

E. Providing for the treatment and transportation of all injured members to the lobby command post.

7.7 FORWARD TRIAGE AREA

7.7.1 The Forward Triage Area (FTA) is established within the building by the Incident Commander.

7.7.2 Its purpose is to ensure the prompt response to fire victims and members.

7.7.3 The FTA shall be established in an environmentally safe location on a floor below the staging area. If conditions deteriorate on this floor, EMS personnel shall change locations. The IC shall be advised.

7.7.4 The IC shall determine, in consultation with the senior Bureau of EMS (BEMS) officer on scene, proper staffing levels of EMT's, Medics and EMS supervisors for the FTA.

8. CLASS "E" COMMUNICATION SYSTEMS

8.1 INTRODUCTION

Because of the large number of people working in office buildings, the large floor areas and the number of floors involved, a system to alert and direct the occupants in the event of a fire and to transmit an alarm to the Fire Department is required. To meet this need, Local Law No. 5 of 1973 provides for the installation of a Class "E" communications system in Class "E" office buildings.

8.2 DESCRIPTION

8.2.1 Class "E" communications systems shall consist of:

A. The fire command station located in the lobby of the building near the elevator control panel.

B. Loudspeakers, operated from the fire command station, which are located on all floors, in all elevators and in all stairway enclosures.

C. Floor warden stations on each floor which provide two-way communications with the fire command station.

D. Manual fire alarm sending stations on each floor.

E. Associated systems:

1. Smoke detection systems.
2. Sprinkler water flow alarms.
3. Thermostatic alarms.
4. Locked door fail safe system.

8.2.2 The fire command station shall include:

A. A hinged cover which permits the flashing "FIRE" signal to be seen. The hinged cover shall be provided with a lock and key.

B. An information display unit capable of monitoring the following systems in order of priority:

1. Manual fire alarm.
2. Smoke detectors.
3. Sprinkler water flow alarms.
4. Elevator lobby detectors.
5. Fire alarm activation.
6. Central office notification.
7. Fan system on / Fan system off.
8. Locked door fail safe system.
9. Fire system trouble.
10. Fire signal trouble.
11. Tamper switch alarm.
12. Power source indicator.
13. Test/normal mode switch.
14. Other information displays as desired.

C. Two-way communications between the fire command station and the following:

1. Floor warden stations.
2. Mechanical control center.
3. Elevators.
4. Air handling control rooms.
5. Elevator machinery rooms.

D. A public address system to all floors, elevators and stairways either selectively or collectively.

E. The capability to transmit an alarm from the fire command post to the Fire Department via a central station.

F. While Local Law No. 5 mandates specific controls and items that must be displayed at the command station, it gives wide latitude to each manufacturer regarding the physical design and hardware that may be used. As a result, many different systems are utilized. This makes an intimate knowledge of each system difficult. Utilize building engineers or fire safety directors (if available) to assist in extracting all information possible from the equipment and an accurate input of Fire Department requirements as ordered by the chief in command of the fire.

8.2.3 A floor warden station shall be located on each floor between the required exits. It shall be provided with:

A. A telephone type handset.

B. Capability to activate a visual and audible signal at the fire command station.

C. Two-way voice communications with the fire command station.

D. Provisions for making announcements over the loudspeaker system on the floor where it is located.

E. A handset, housing and door painted red and lettered "Fire Emergency-Open Door to Operate".

8.2.4 At least one manual fire alarm sending station shall be located in each path of escape in each story of a building. Additional stations shall be installed so that no point on any floor shall be more than 200 feet from the nearest station. The activation shall cause:

A. Automatic transmission to the Fire Department via a central station.

B. A visual and audible signal at the fire command station, mechanical control center and the regularly assigned location of the fire safety director.

C. Sounding of the alarm on the fire floor and the floor above.

8.2.5 An approved combustion ionization detection device or a combination of an approved smoke detecting device and an approved fixed temperature thermostatic device shall be installed:

A. At each elevator landing, the activation of this device shall:

1. Recall the elevators.
2. Sound the fire alarm signal on the fire floor and the floor above.
3. Cause a fire alarm signal to be transmitted to the Fire Department via a central station.
4. Cause a fire alarm signal to be sounded at the fire command station, the mechanical control center and the regularly assigned location of the fire safety director.
5. Stop the air supply into and the return air from the floor where activated.
6. Activate the air exhaust fans and dampers in the smoke shaft or the pressurizing fans in the stair enclosure.
7. Unlock the doors on the locked fail safe system.

B. Within the HVAC system, the activation of this device shall accomplish all of the actions listed in 8.2.5A with the exception of recalling the elevators.

8.2.6 The activation of a sprinkler water flow alarm shall accomplish all of the actions as listed in Section 8.2.5A.

8.3 UTILIZATION OF THE CLASS "E" SYSTEM

8.3.1 The chief in charge of the command post will be able to obtain the following information from the fire command station:

A. The location and time of activation of the:

1. Manual pull stations.
2. Smoke detecting devices.
3. Thermostatic detecting devices.
4. Sprinkler water flow alarms.

B. Status of the HVAC system.

C. Status of the elevators.

8.3.2 The communication features of the class "E" system can be used as follows:

A. The public address system:

1. To communicate with the building occupants.
2. To control evacuation.
3. To communicate with Fire Department personnel.

B. The warden telephone system:

1. To communicate with the floor wardens.
2. To establish hardwire communications with Fire Department personnel at the:
   a. Operations Post.
   b. SAE Post.
   c. Staging area.
   d. Other locations.

C. Two-way communications with:

1. Elevators.
2. Fire Pump room.
3. Mechanical control center.
4. Air handling control center.

9. LADDER COMPANY OPERATIONS

9.1 INTRODUCTION

9.1.1 Fires in High-Rise office buildings present unusual complex problems to the first arriving units. It is essential that the first alarm ladder companies define the fire problem and convey this information to the officer in charge and provide for the rescue and evacuation of occupants in affected areas. The information gathered by the first alarm ladder companies and relayed to the lobby command post will determine to a large extent the success of the overall fire operations.

9.2 LADDER COMPANY RESPONSIBILITIES

9.2.1 General goals of first alarm ladder companies.

A. Gain control of elevators.

B. Locate fire floor and determine the best access thereto.

C. Ascertain the general area and extent of the fire on the floor.

D. Provide the necessary search and evacuation of occupants on the fire floor.

E. Conduct a preliminary search and examination of the floor above the fire.

F. Initiate search and examination of the upper most floors of the building.

G. Reconnaissance of the exterior of the building.

9.3 FIRST ARRIVING LADDER COMPANY

9.3.1 The first arriving ladder company shall:

A. Obtain as much information as possible from the fire safety director or his surrogate as to:

1. Location of the fire.
2. Evacuation procedures that have been implemented.
3. Status of elevators.
4. Access stairs serving the fire floor.

B. Prior to leaving the lobby:

1. Determine the elevator bank that provides the safest access to the fire area and place the elevator cars to be used on "Firemen Service".
2. Obtain floor plan of the fire area. If only one copy is available do not remove it from the fire command station.
3. Obtain keys necessary to gain access to the fire floor.
4. Insure that the lobby command post is manned by a fire department member.

5. Due to HVAC and the stack effect, smoke can permeate the entire zone (up to 25 floors) and cause confusion as to the specific fire floor. Numerous reports of fire or smoke may be received and even the original alarm may be from the incorrect floor. Always be prepared for the unexpected, especially when elevators are being utilized.

C. Conduct a preliminary inspection of the exterior of the building by the chauffeur for:

1. Persons in distress.
2. Smoke or fire showing through the skin of the building.
3. The need for any exterior operations.

D. Proceed to a floor at least two floor below the fire floor using a "Firemen Service" elevator as outlined in section 3. A fireman equipped with a Handie-Talkie shall be assigned to remain with the elevator and to operate the elevator until relieved.

E. Upon arrival at the floor below the fire. conduct the following operations and relay all information obtained to the lobby command post:

1. Determine if the reported fire floor is the correct location and return the elevator to the lobby to transport the engine companies.
2. Determine the heat and smoke condition on the fire floor.
3. Determine the life hazard on the fire floor and initiate evacuation procedures where required.
4. Determine the location of the fire on the floor and select a stairway with a standpipe that will provide the best attack on the fire.
5. Conduct a primary search of the fire floor.
6. Provide support to the advancing Engine Company by:
   a. Removing obstructions.
   b. Forcing entry.
   c. Opening the ceiling to expose the plenum.

9.4 SECOND ARRIVING LADDER COMPANY

9.4.1 Due to the utilization of manpower from the 1st arriving Ladder Company for:

A. Examination of building exterior.

B. Elevator car operator.

C. Temporary Lobby Command Post supervisor, plus the large area that MUST be searched mandates that the second arriving Ladder Company assists in the search and evacuation of the fire floor.

9.4.2 The second arriving ladder company shall:

A. Report to the lobby command post.

1. Determine if the fire floor has been verified by the first arriving ladder company.
2. Obtain an elevator car that provides the safest access to the fire area and place the car on "Firemen Service". If possible, the same elevator car used by the 1st arriving, ladder (manned by a H.T. radio equipped member of the 1st ladder company) should be utilized. If a different car must be utilized, a H.T. radio equipped member of the 2nd ladder shall be assigned to remain with the elevator and operate car until relieved.
3. Upon arriving at the floor below the fire (or on the fire floor) obtain as much information as possible from the 1st arriving ladder company - areas searched, fire area location, occupants reported missing, etc.
4. Coordinate the search operation of fire floor with first arriving ladder company.

9.5 THIRD ARRIVING LADDER COMPANY

9.5.1 The third arriving ladder company shall:

A. Report to the lobby command post.

1. Determine if the fire floor has been verified by either the 1st or 2nd arriving ladder company.
2. Obtain an elevator that provides the safest access to the fire area and place the car on "Firemen Service".
3. Proceed to a floor at least two floors below the fire floor, using a "Firemen Service" elevator as outlined in section 3.

Note: The 1st arriving and possibly the 2nd arriving ladder company will already have a H.T. radio equipped member operating one of the "Firemen Service" elevators. Use these cars if available rather than losing a member to operate another car. In ALL cases each elevator car used to transport Fire Dept. members a H.T. equipped member shall be assigned to operate the car. These cars shall then be returned promptly to the lobby to transport additional men or equipment.

B. Upon arriving at the floor below the fire, obtain as much information as possible from the 1st or 2nd arriving ladder company OR by a rapid survey or reconnaissance of this floor and stairway serving it. Signs posted in elevator lobbies ("YOU ARE HERE" signs) can also be used for such familiarization. The Officer and member shall then:

1. Determine the number of stairways serving the fire floor and the floor above.
2. Proceed to the floor above the fire via a stairway other than the attack stairway.
3. Determine which stairway is the best stairway to be used by the occupants for evacuation and advise the lobby command post.
4. Examine the floor above the fire and report to the lobby command post the following:
   a. The heat and smoke conditions.
   b. The status of the evacuation.
   c. Any extension of the fire.
   d. Presence of Access Stairs - Down to Fire Floor or Upward to Floor Above.
5. Examine all stairways for occupants and smoke condition.
6. Remove all occupants from the attack stairway for a reasonable distance above the fire floor and prevent its use by the occupants.
7. If difficulty is encountered in clearing the attack stairway of occupants, the officer shall advise the first arriving ladder company or the operations post to withhold the attack until the occupants have been safely removed.
8. Conduct a primary search of the floor above the fire.

C. When his operations are completed on the floor above the fire, report to the operations post either physically or via H. T Radio.

D. Notification to Chief in Charge of Command Post or Operational Post of Missions NOT accomplished can be more important than assignments accomplished.

9.6 FOURTH ARRIVING LADDER COMPANY

9.6.1 The Fourth arriving ladder company shall:

A. Report to the lobby command post.

1. Each member shall be equipped with an extra Scott cylinder.

2. Obtain an elevator that provides the safest access to the roof.

   a. If the fire is on a floor that is not serviced by the High-Rise bank of elevators, the High-Rise bank will be used if it is in a blind shaft.

   b. If the fire is on a floor that is serviced by the High-Rise bank of elevators, they shall proceed to a location below the fire floor and then use a stairway other than the attack stairway to proceed to the roof.

   c. If the High-Rise bank of elevators is used, assign a member equipped with a Handie-Talkie to operate the "Firemen Service" elevator until relieved.

B. Upon arrival at the roof area the officer shall:

1. Report the following conditions to the lobby command Post.

   a. Smoke and heat conditions in the area and in the stairways.

   b. The presence of any building occupants.

   c. All means available for roof ventilation, especially over stair ways and elevator shafts.

   d. Any unusual conditions.

   e. Fire or occupants at windows visible from roof.

C. Not undertake roof ventilation unless ordered by the Chief in Charge of the lobby command post.

D. Determine the identification of all stairways and elevator shafts so that when ordered, the correct ventilation can be carried out.

E. Conduct a primary search of the top five floors.

F. Remove any occupants to a safe area or assure the occupants what they are safe to remain where they are.

G. Remain in the roof area to monitor and report any changing condition until other wise ordered by the lobby command post.

H. A logical assignment after roof operations would be the terminal floor of elevator bank serving the fire floor.

I. Operate under the control of the lobby command post until the SAE post is established. They shall then operate under the command of the SAE post.

9.7 CARBON MONOXIDE METERS

9.7.1 All ladder companies equipped with Carbon Monoxide Meters, when responding to hi-rise fires after the Second Alarm assignment, shall report to the Lobby Command Post with their Meters.

10. ENGINE COMPANY OPERATIONS

10.1 INTRODUCTION

10.1.1 The many variables and complexities built into High-Rise office buildings may be compounded by both the fire location and the fire load within the tenant space on the floor.

10.1.2 Many fires will be within easy reach of hose streams operated from the immediate area of the stairway enclosure, but other fires may require both the combining of rolled up lengths and manpower of the first and second due units to advance the first hose line.

10.2 ENGINE COMPANY RESPONSIBILITIES

10.2.1 The general goals of the first alarm engine companies are:

A. To stretch sufficient hose to reach the fire and be able to operate effectively during the initial stages of operation.

B. Provide relief of the member operating the first hose lines.

C. Supply the standpipe and sprinkler systems as per sec. 5.

10.3 FIRST ARRIVING ENGINE COMPANY

10.3.1 The first arriving engine company shall:

A. If first to arrive, obtain as much information as possible from the fire safety director or his surrogate with regard to:

1. Location of the fire.
2. Evacuation procedure that have been implemented.
3. Status of the elevators.
4. Access stairs serving the fire floor.

B. Remain at the lobby command post until the first ladder company has verified the fire location.

C. Proceed to the upper floor via the elevator manned by the member of the first ladder company.

D. With the assistance of the second arriving engine company, stretch a hose line from the standpipe outlet on the floor below the fire in the designated stairway.

E. Operate the first hose line until relieved by the second arriving engine company.

10.4 SECOND ARRIVING ENGINE COMPANY

10.4.1 The second arriving engine company shall:

A. Report to the officer in command of the lobby command post.

B. Proceed to the location of the first engine company via a manned "Firemen Service" elevator.

C. Assist the first arriving engine company in stretching sufficient hose to reach the fire.

D. Provide Handie-Talkie communications between the standpipe outlet and the nozzle by having the officer of the second arriving engine company remain at the outlet until the hose line is operating at the correct nozzle pressure.

E. Leave the fire area when the hose line has been stretched and is operating so as not to deplete their air supply.

F. Coordinate with the officer in command of the first hose line so that the relief of members operating the line can be accomplished before their masks are expended.

10.5 THIRD AND FOURTH ARRIVING ENGINE COMPANIES

10.5.1 The third and fourth arriving engine companies shall:

A. Report to the chief in charge of the lobby command post.

B. Operate in a manner similar to the first and second engine companies to stretch the second hose line.

C. Stretch and operate the second hose line as directed by the chief in charge of the operations post or the lobby command post. This hose line may be used to:

1. Reinforce the position of the first line.
2. Protect the position of the first line.
3. Protect the search and evacuation of the fire floor.
4. Contain and confine fire spread and/or prevent fire wrapping around the core and endangering operation of the first line.

10.6 GREATER ALARM ENGINE COMPANIES

10.6.1 Greater alarm engine companies shall report to the lobby command post for assignment to the operations post, SAE post or the staging area. Some of the duties they may be assigned to are:

A. Relieve any of the first alarm units.

B. Stretch additional hose line on the fire floor or the floors above.

C. Assist in the search and evacuation of upper floors.

D. Transport special tools and equipment to the staging area.

10.6.2 Units, without specific orders to the contrary shall bring masks, rolled up lengths and spare Scott cylinders to lobby area. If not required for their specific use, such equipment will be added to staging area supply for future use by units engaged in actual fire fighting operations.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

APPENDIX 1 - REFERENCE FIGURES

Appendix I
Fire Fighting Procedure High Rise Office Buildings
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Figure 2-1

COMPOSITE FLOOR

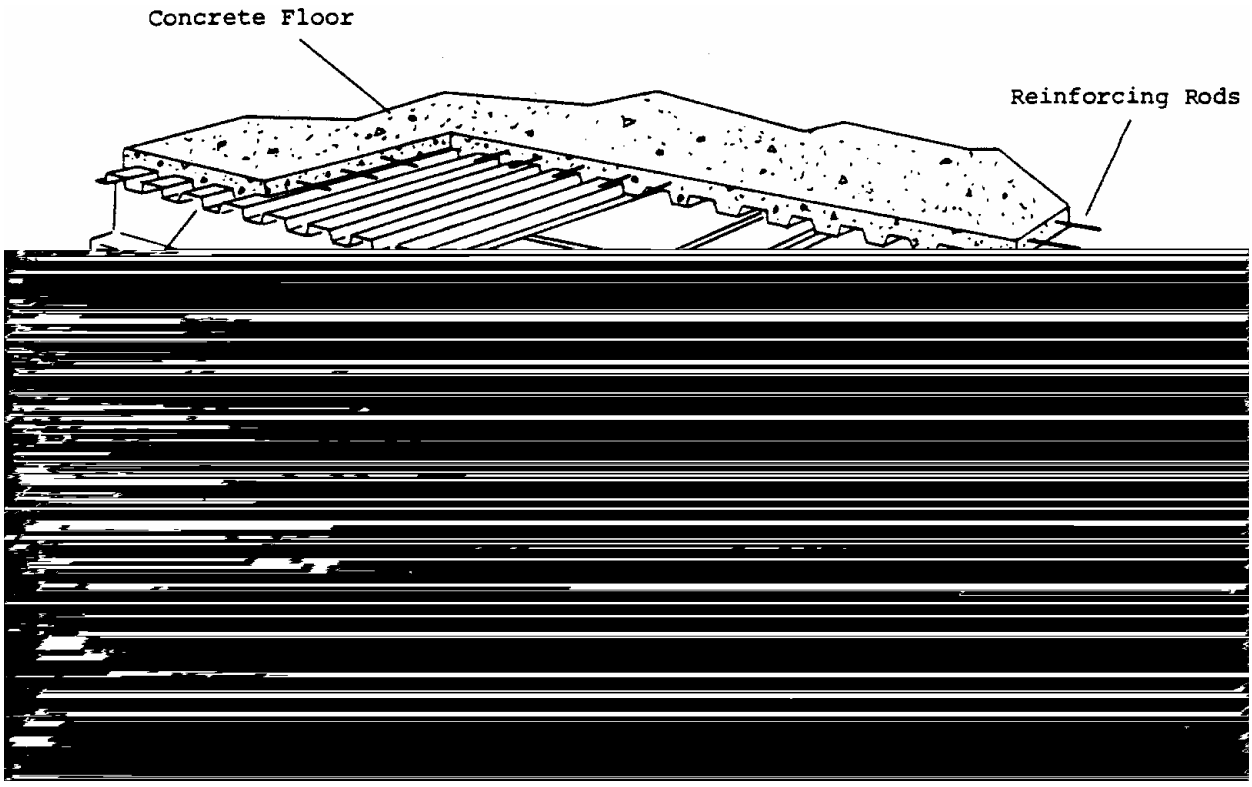


Figure 4-1

MER EQUIPMENT

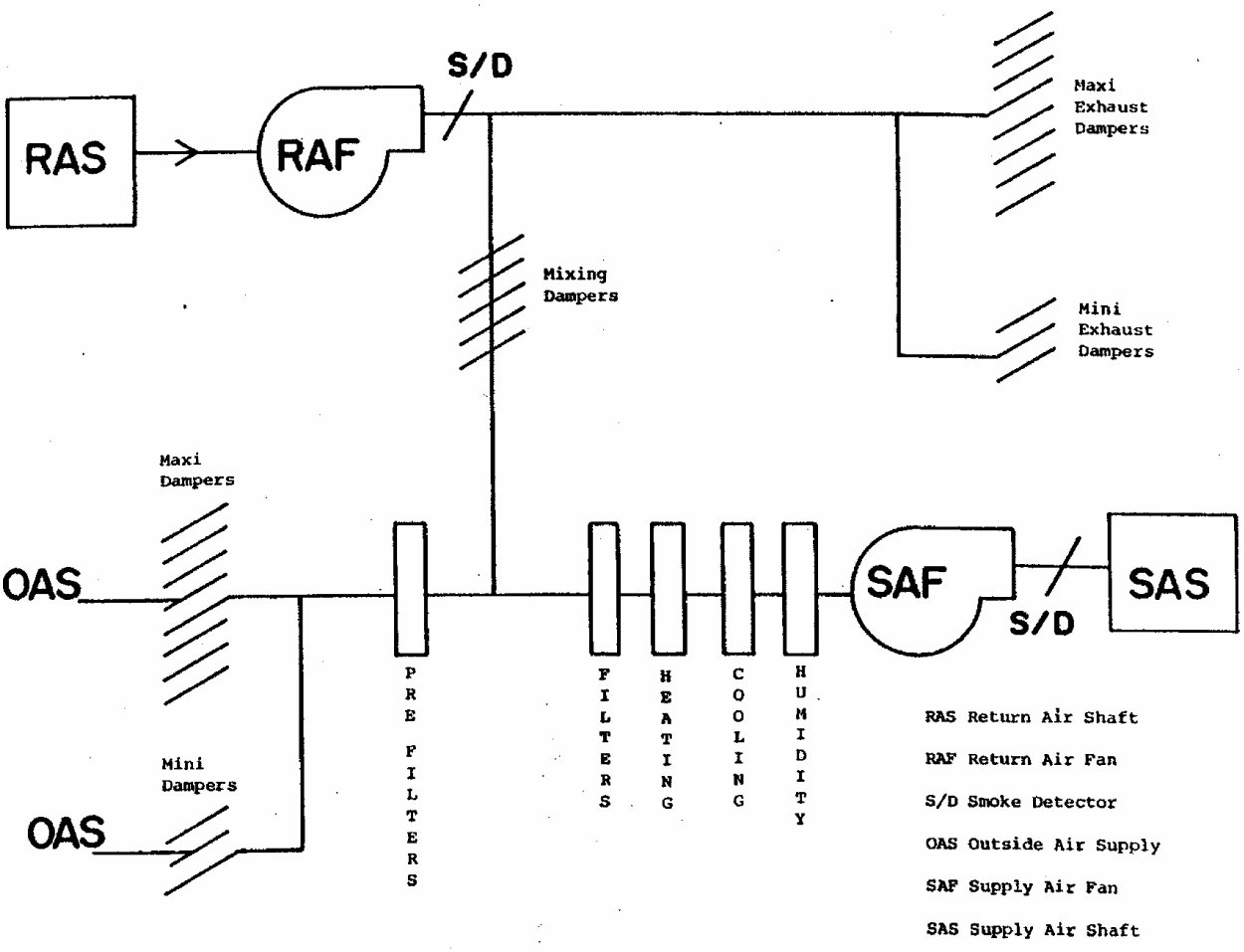


Figure 4-2

HVAC DISTRIBUTION SYSTEM

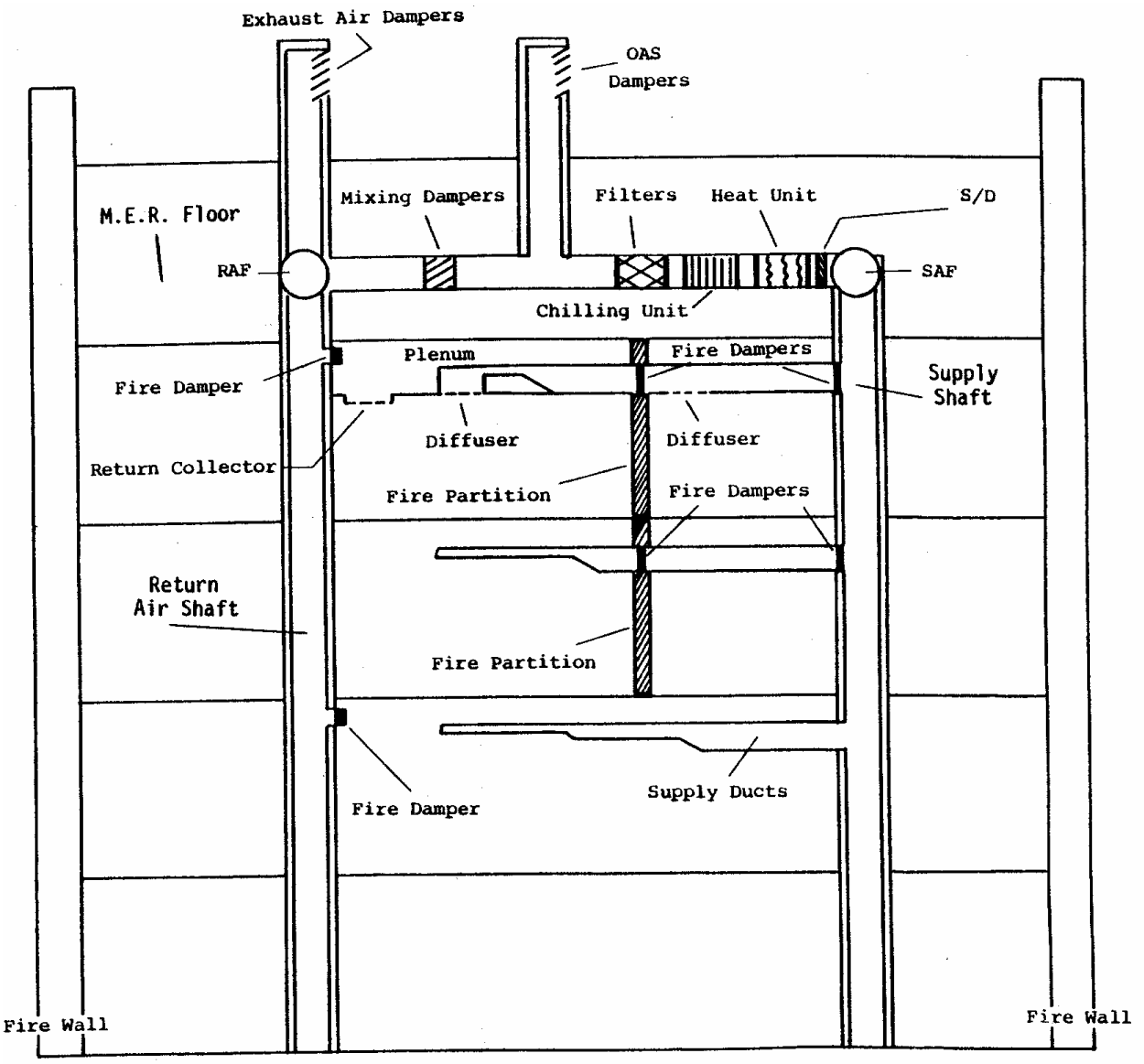


Figure 4-3

HVAC ZONES

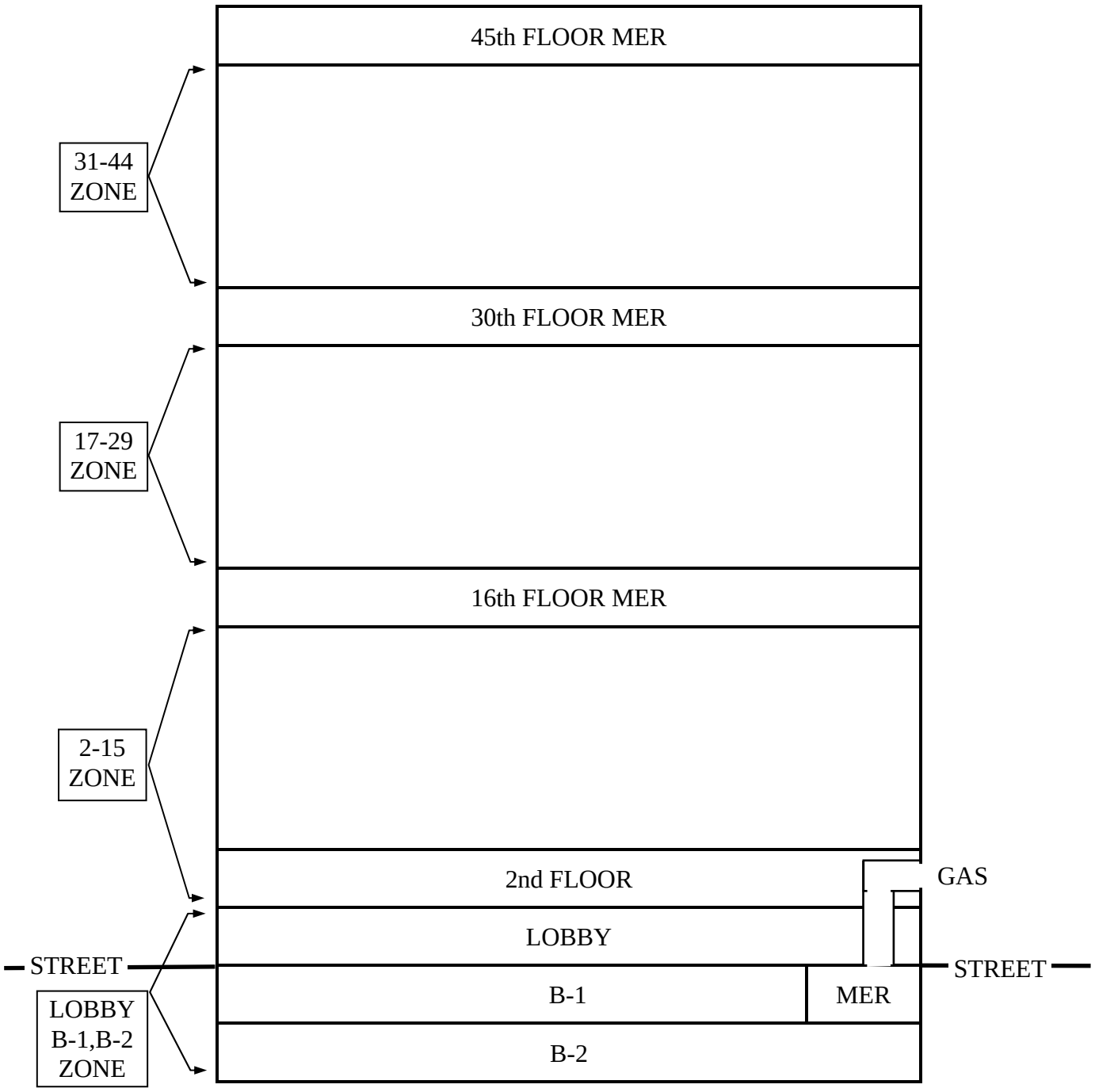
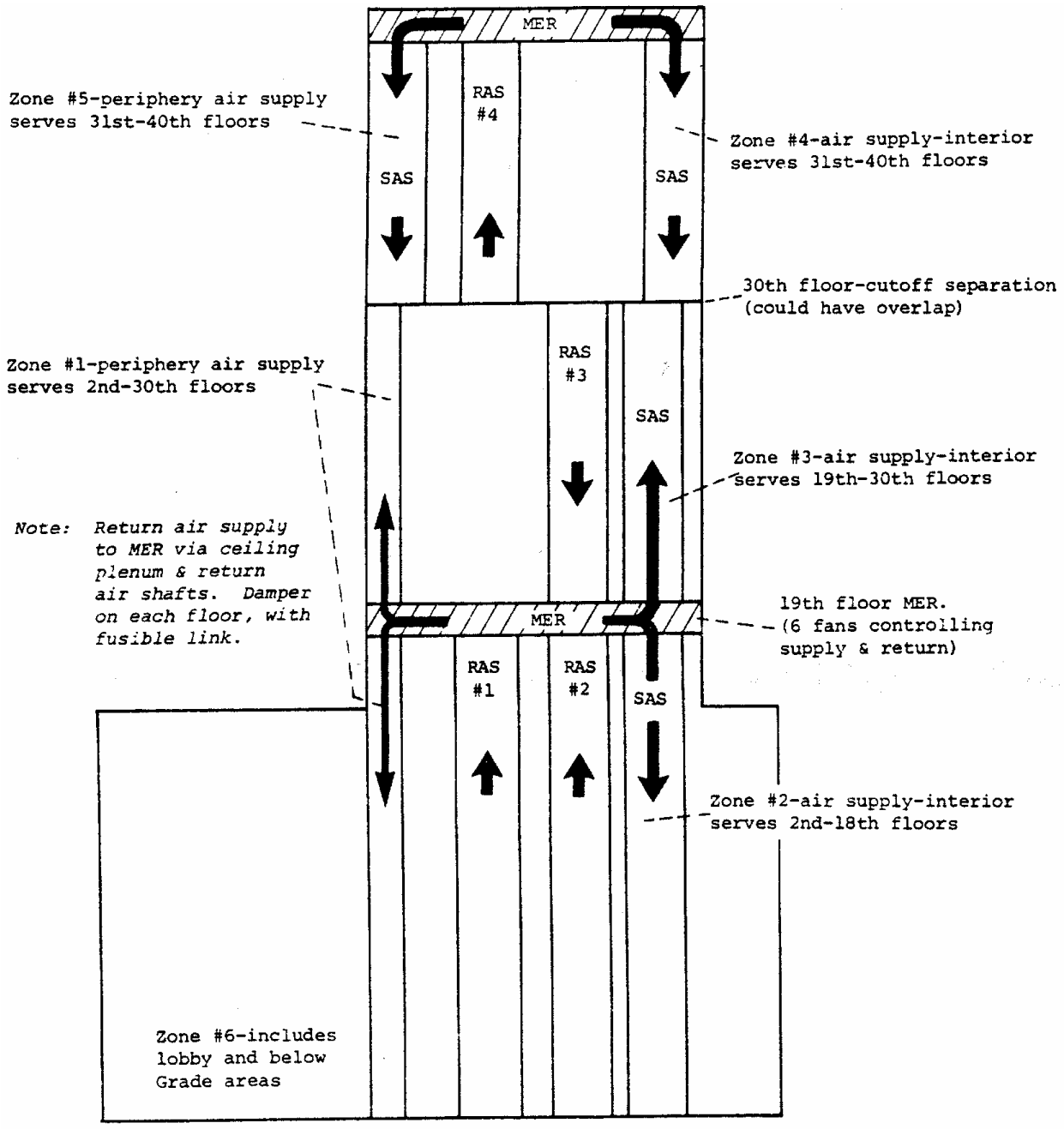


Figure 2-1

HVAC (6 ZONES)



NOTE: Drawing simplified, each supply zone could be interchanged due to fan arrangement

Figure 5-1

MODEL FIRE PUMP
SHOWING POSSIBLE BYPASS & BYPASS VALVE LOCATION

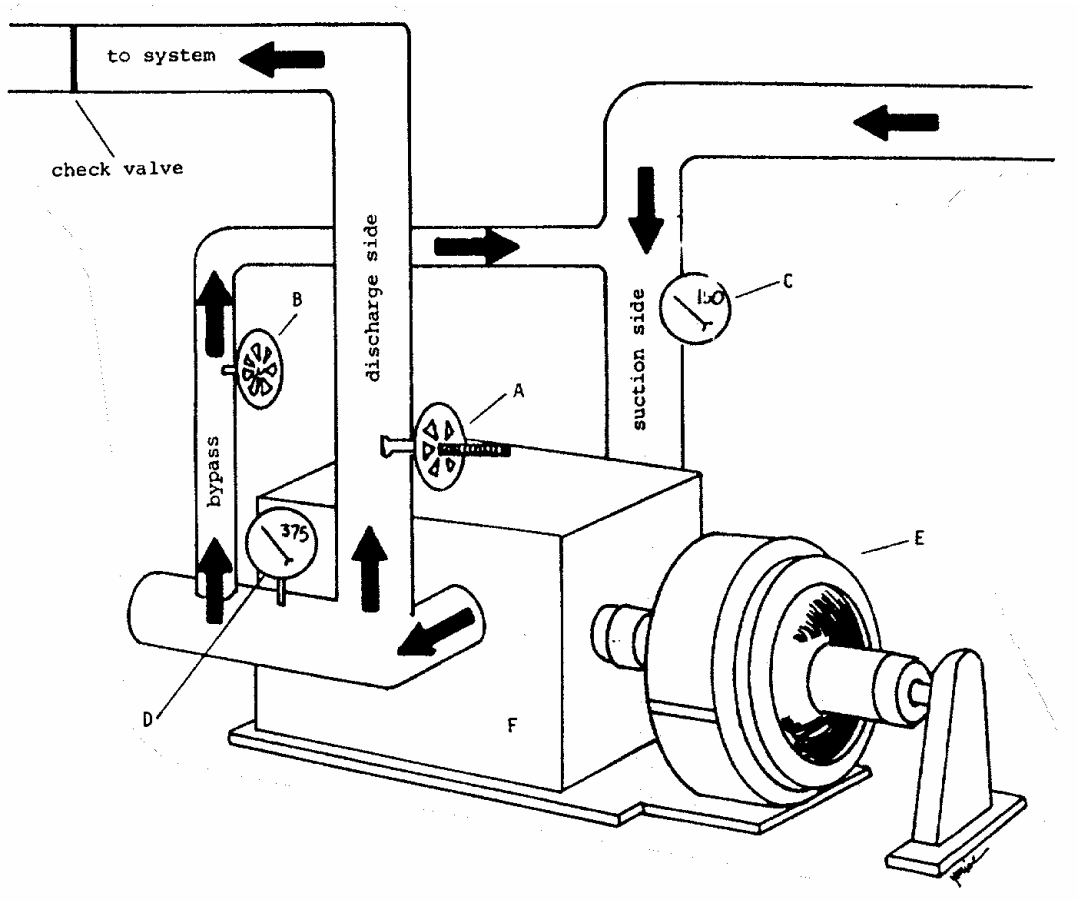
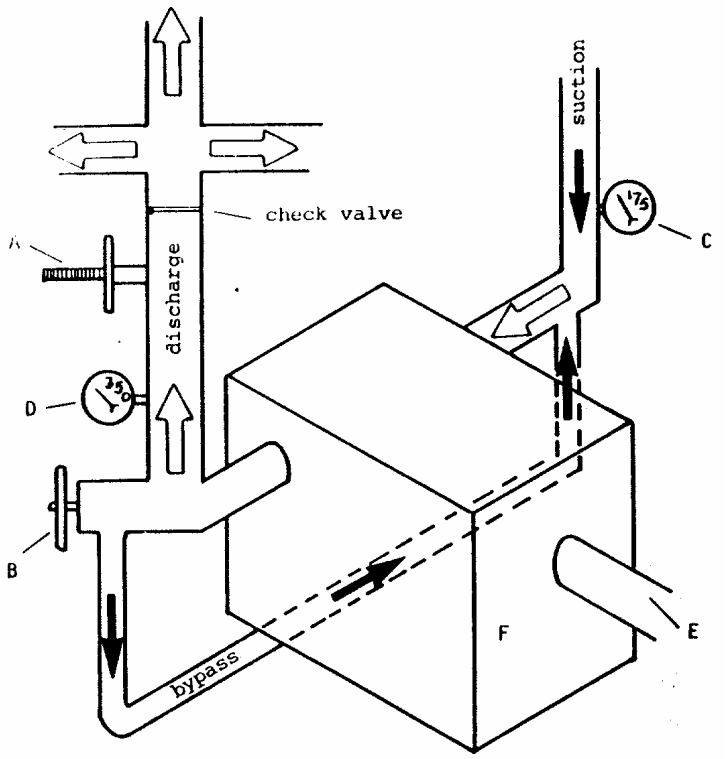


Figure 5-2



MODEL FIRE PUMP SHOWING POSSIBLE BYPASS & BYPASS VALVE LOCATION			
A.	OPEN O.S.&Y. VALVE	E.	TO DRIVE MOTOR
B.	CLOSED	F.	CENTRIFUGAL
C.	INLET GAUGE	→	DESIGNATES DIRECTION OF WATER FLOW
D.	DISCHARGE GAUGE		

Figure 5-3

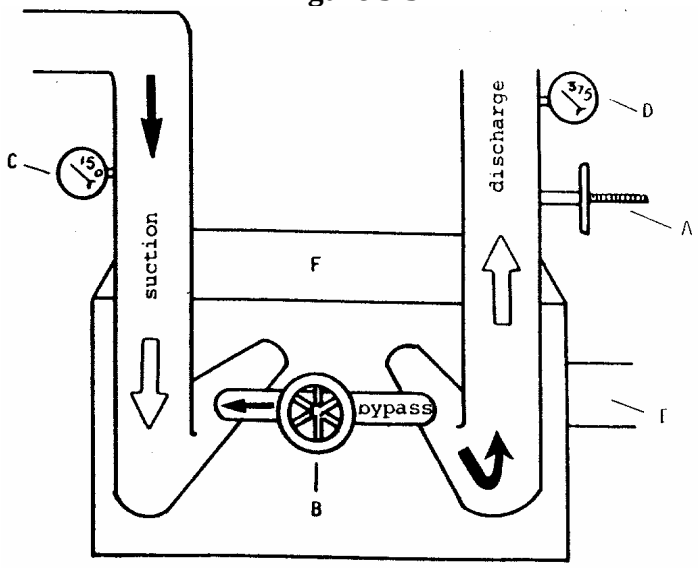
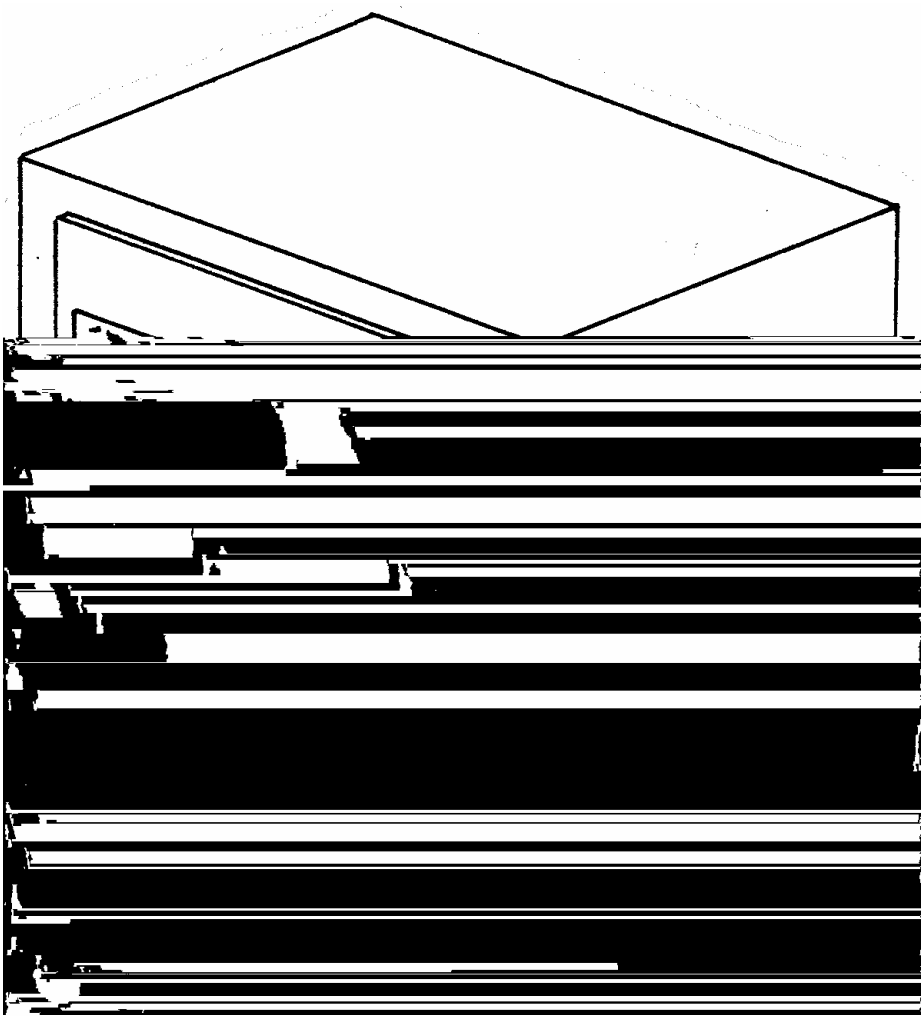


Figure 5-4

FIRE PUMP CONTROL
(FIRETROL)



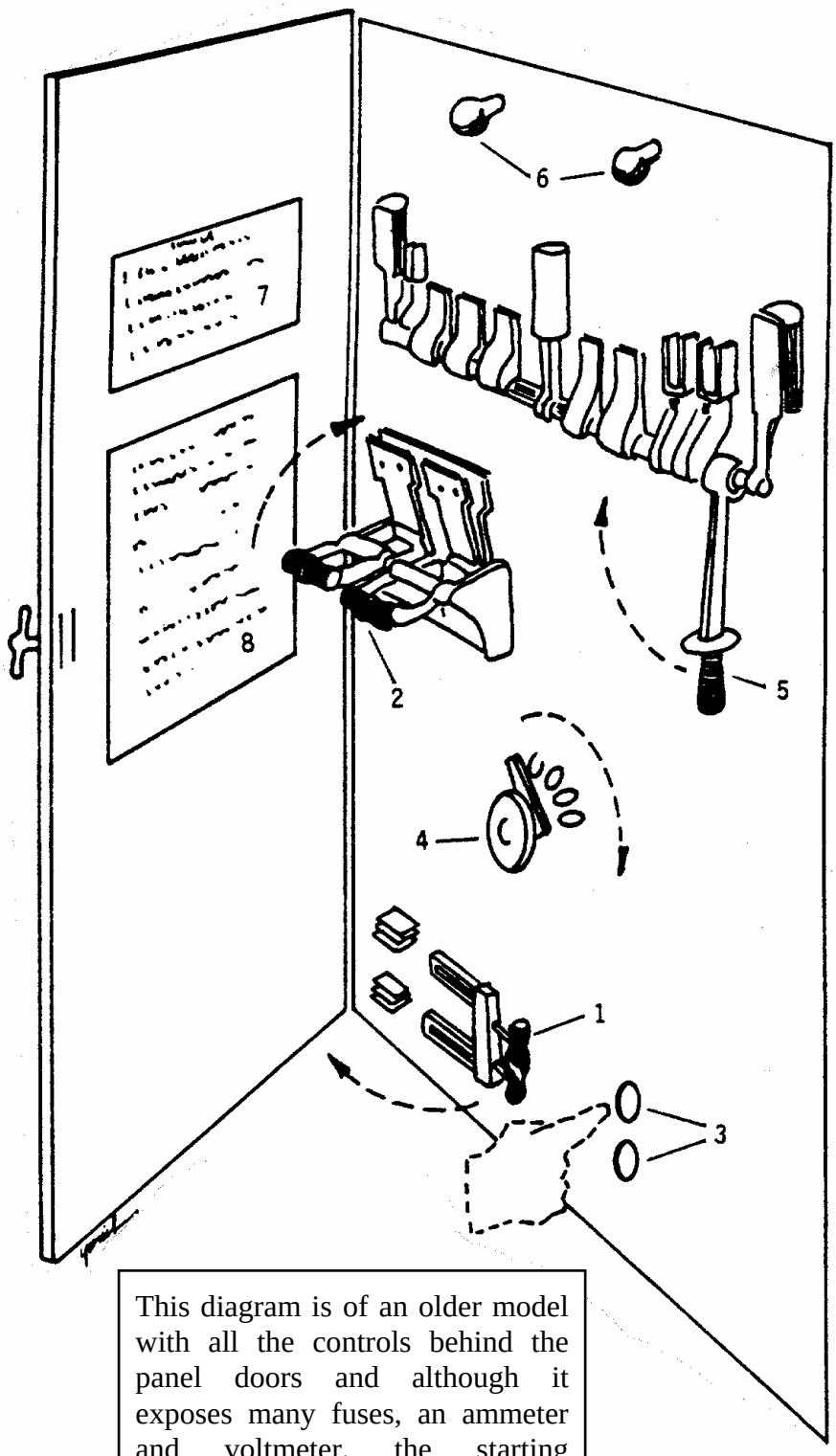
1. Knife switch control
2. Circuit breaker control
3. Start-Stop buttons
4. Pump position lever (speed)
5. Emergency power control lever
6. Power “on”, Pump “on” lights
7. Instruction panel
8. Pump pressure chart

Control Panels may vary in appearance, but operational sequence remains the same.

On newer models such as the illustrated controls above, the controls are located on the outside of a locked door which covers the fuses and high voltage lines. This simplifies the operation because the operator sees only the starting mechanism that is needed for operation.

Figure 5-5

FIRE PUMP CONTROL PANEL



1. Knife switch
2. Circuit breakers
3. "ON" - "OFF" buttons
4. Pump speed lever
5. Emergency power lever
6. Power "on", pump "on" lights
7. Instruction panel
8. Pump pressure chart

When the proper sequence is followed as outlined, the power "on" light will glow with the closing of the circuit breakers and the pump "on" light will glow with the pushing of the starting button.

NOTE

A variation of this panel may have the knife switch inside panel door as shown with all other controls on the outside of door, through holes in door. On this type it will be necessary to open door to close knife switch before reclosing door and completing operation.

This diagram is of an older model with all the controls behind the panel doors and although it exposes many fuses, an ammeter and voltmeter, the starting mechanism parts and sequence remain the same

Figure 6-1
HIGH RISE CHECK LIST

Fire Location & Conditions

Fire Location_____
Fire Conditions Heavy ☐ Med ☐ Lt ☐
Smoke Conditions Heavy ☐ Med ☐ Lt ☐
Heat Conditions Heavy ☐ Med ☐ Lt ☐

Elevators

	Yes	No
Elevators Down	☐	☐
Fireman Service	☐	☐

No. of Cars for F.D. Use
Low _____Med _____ High _____
Floors Served

Building Information

	Yes	No
Sprinklered	☐	☐
Floor Plans	☐	☐
Stair Re-entry Keys	☐	☐
Window Keys	☐	☐
Occupancy Keys	☐	☐
Open Stairs-Fire Occ.	☐	☐
Building Setbacks	☐	☐

Communications

	Yes	No
Class "E"	☐	☐
Public Address	☐	☐
S.P. Phone	☐	☐
To Fan Rooms	☐	☐
To Engineer	☐	☐
Public Telephone	☐	☐
Alarm System Turned Off	☐	☐

Life Hazard

	Yes	No
Trapped	☐	☐
Fire Floor Evac.	☐	☐
Floor Above Evac.	☐	☐
Primary Search Compl.	☐	☐
Secondary Search Compl.	☐	☐
Elevators Searched	☐	☐

HVAC (Heating, Ventilation, Air Conditioning)
Shut Down Yes☐ No☐
*Mer_____ Floor Serves _____To ____
Mer _____ Floor Serves _____To ____
Mer _____ Floor Serves _____To ____
Number of Zones_____
*Mer Mechanical Equipment Room

Stairs Identification

Letter	Floors	Served	S.P.	Evac.
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Scissor Type Stairs Yes☐ No☐

Water Supply

	Yes	No
Standpipe Fed	☐	☐
Sprinkler Fed	☐	☐
Bldg. Fire Pumps On	☐	☐

Unit(s) Feeding Stp.
Pressures Required
1-10(150#) 10-20(200#) 20-30(250#)
30-40(300#) 40-50(350#) 50-60(400#)

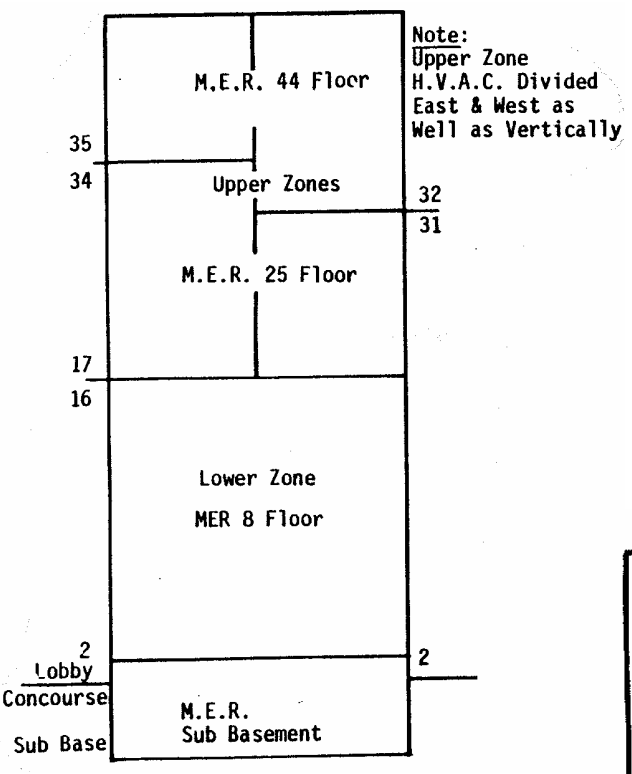
UNIT LOCATIONS

1st Eng. Floor _____ Stair _____
2nd Eng. Floor _____ Stair _____
3rd Eng. Floor _____ Stair _____
4th Eng. Floor _____ Stair _____
2nd Batt. Ch. Floor _____ Stair _____
3rd Batt. Ch. _____

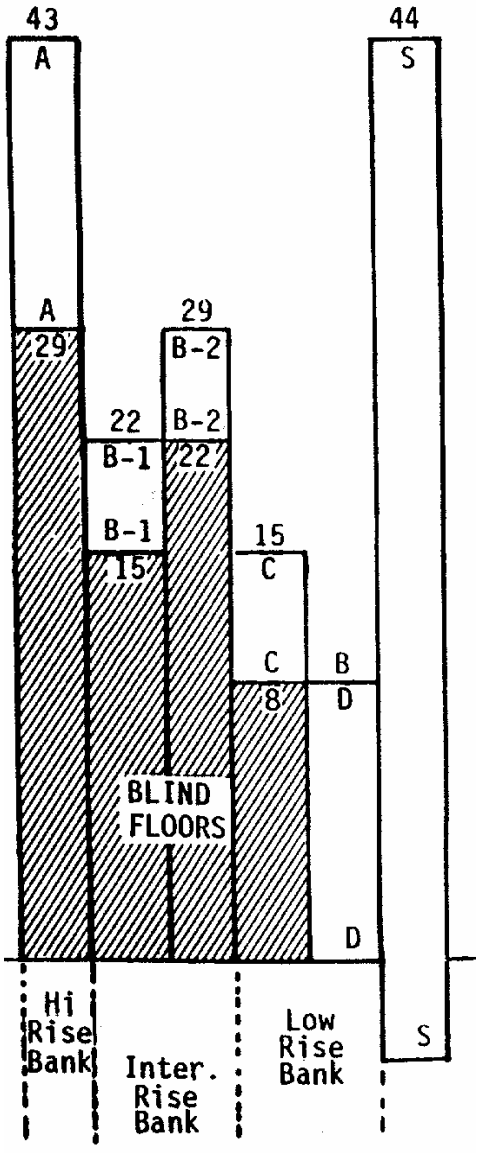
1st Ladder Floor _____ Stair _____
2nd Ladder Floor _____ Stair _____
3rd Ladder Floor _____ Stair _____
Rescue _____
Assignment

Figure 6-3
SAMPLE BUILDING FLOOR PLAN AND PROFILE

HVAC SYSTEM



ELEVATORS



STAIR SHAFTS

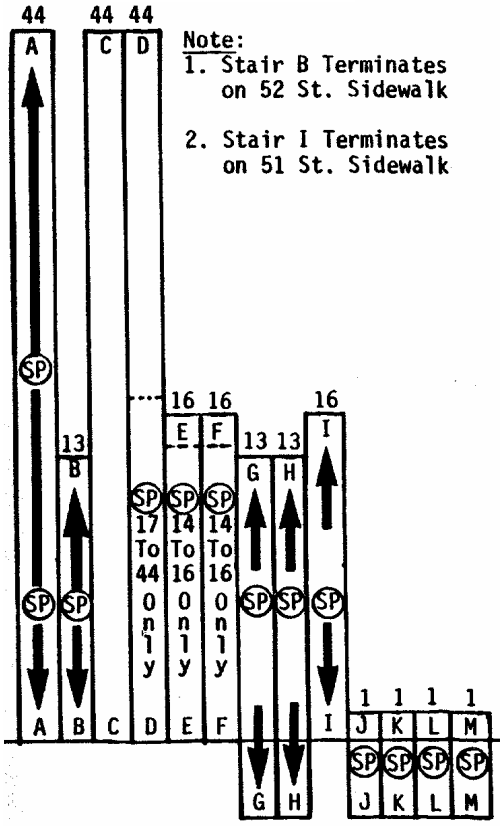


Figure 6-4

SAMPLE TIPS DATA SHEET

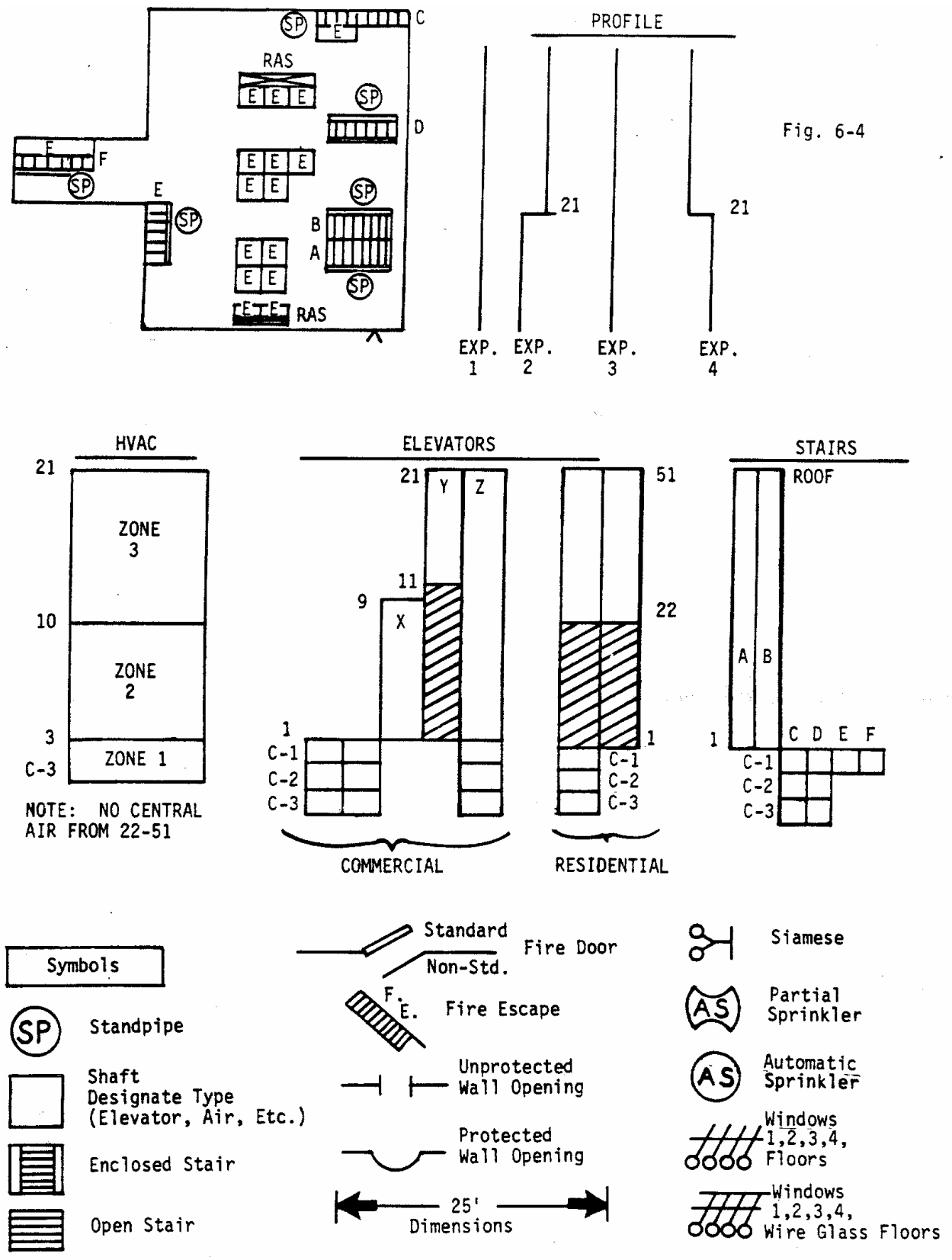


Fig. 6-4

Figure 6-2
OPERATIONS POST LOG

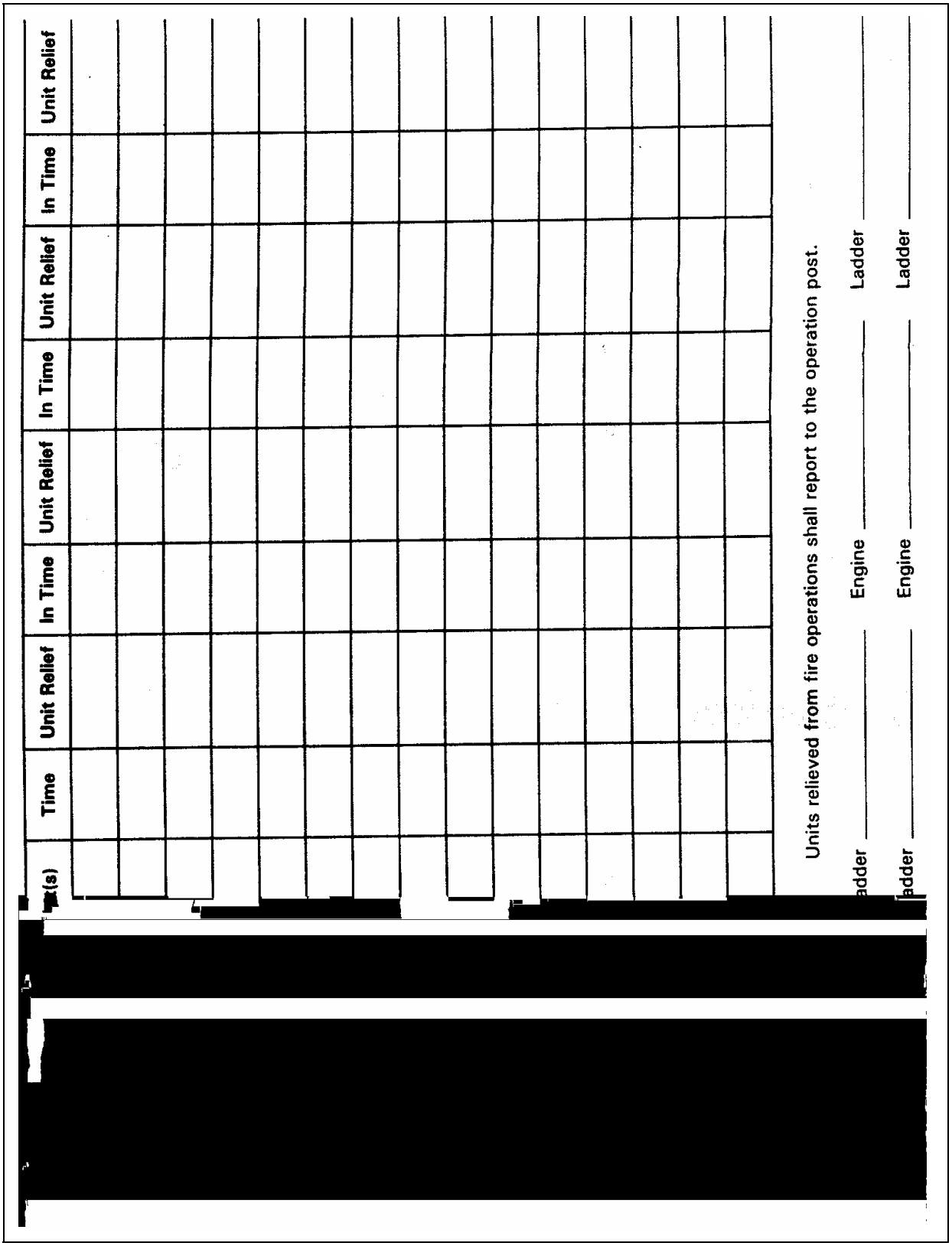
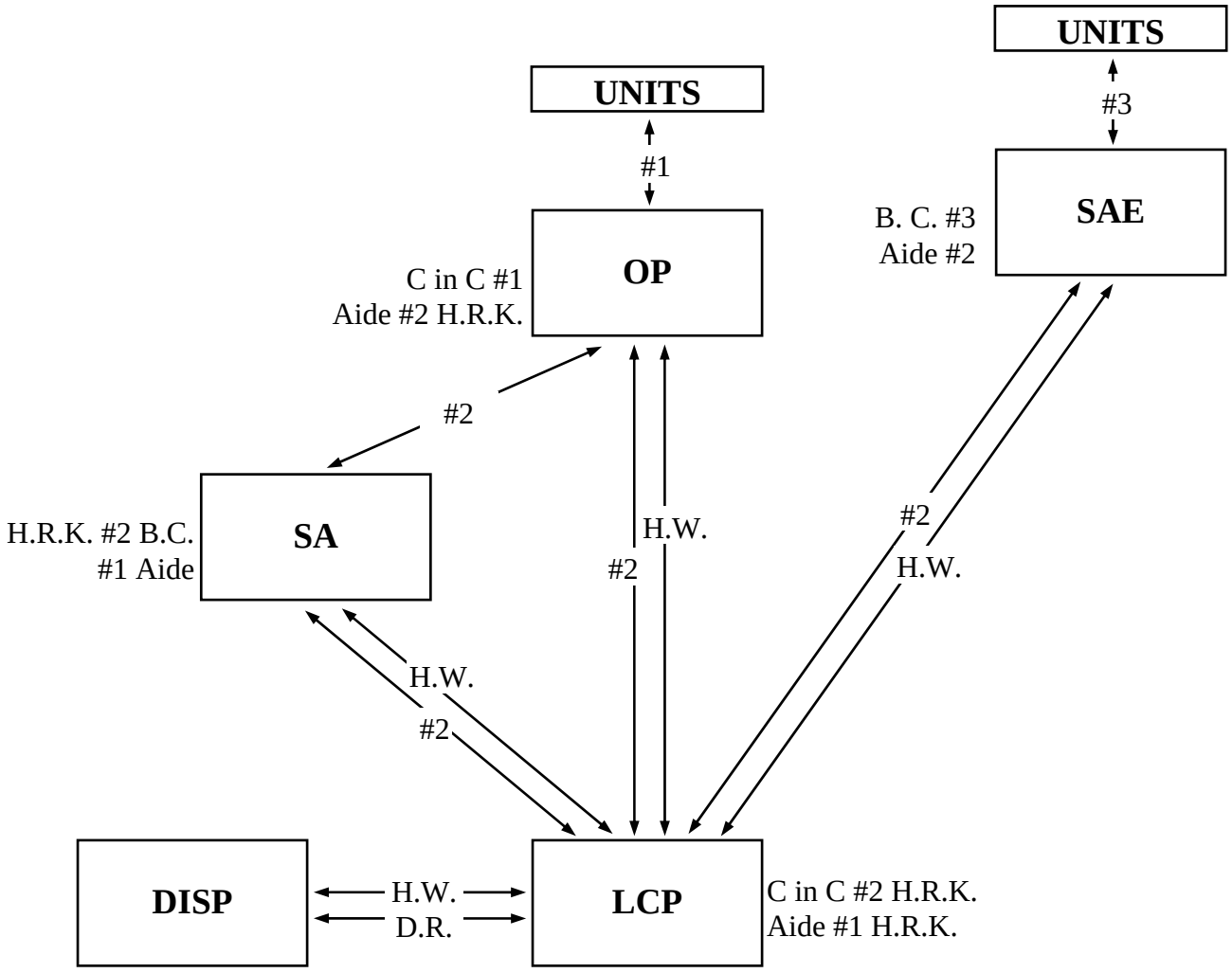


Figure 7-1

COMMUNICATIONS NETWORK



LEGEND	
#1	Tactical
#2	Command
#3	Second Tactical
H.W.	Hard Wire
D.R.	Dept. Radio
LCP	Lobby Command Post
SA	Staging Area
OP	Operations
SAE	Search & Evacuation post
HRK	High Rise (Communications) Kit

H.W. - Hardwire Components

1. Class E System
2. Standpipe Telephone
3. Outside Telephone
4. In-house Telephone
5. Sound Power Field Telephone

Figure 7-2

LOBBY COMMAND LOG

Units Reporting To Lobby Command Post	Units To Operations Post	Units To SAE Post	Units To Staging Area	Units In Reserve At Lobby Command Post

Figure 7-4

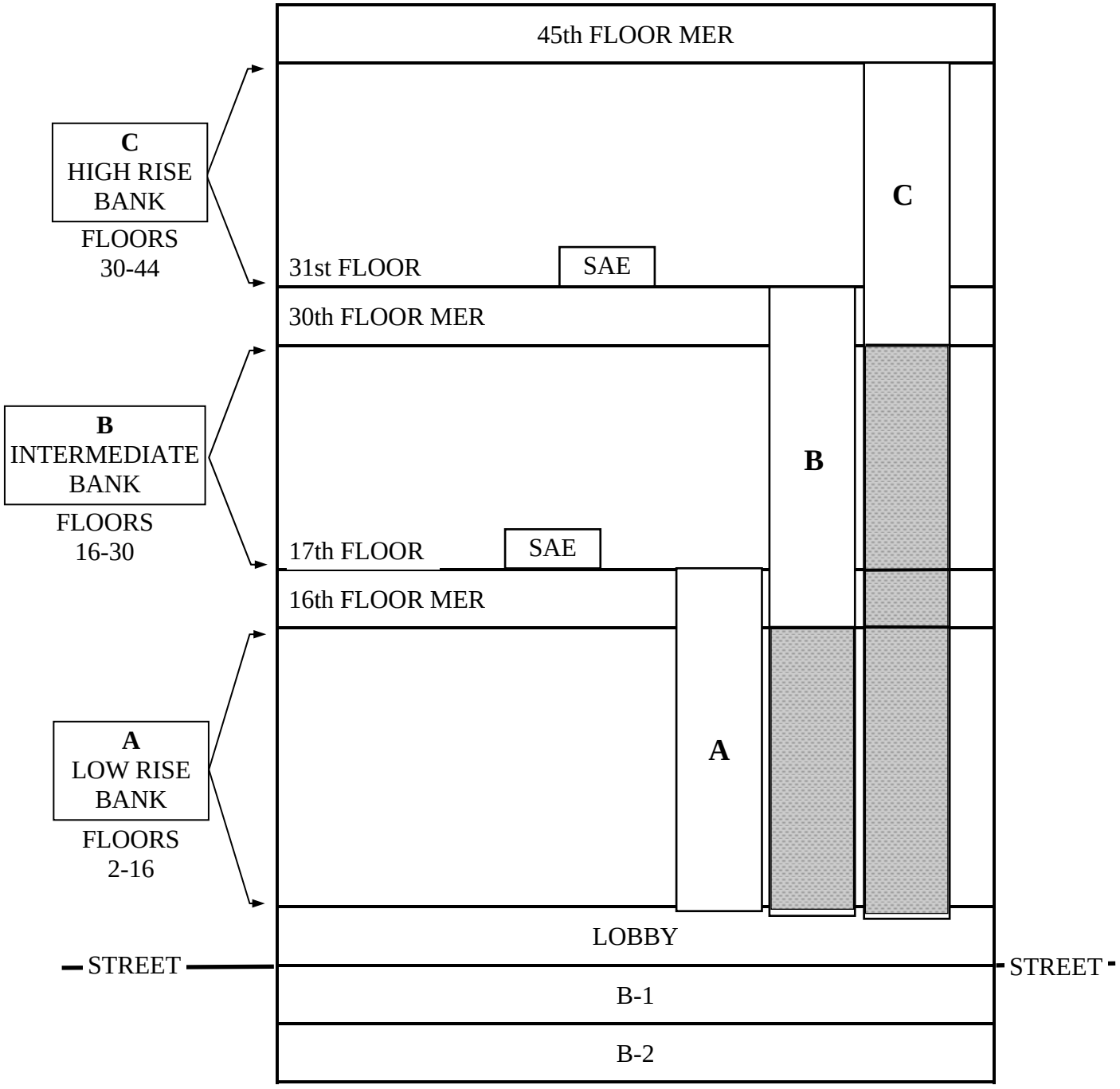
STAGING AREA LOG

Units Reporting In		Units Departing			Units Returning		
Units	Time	Unit	Assignment	Time	Units	Time	Serviceable

RECORD OF INJURIES

Unit	Name	Time	Injury	Disposition

Figure 7-3



NOTE: Shaded area is a blind shaft

Appendix J
WORLD TRADE CENTER EMERGENCY PROCEDURES MANUAL 2001

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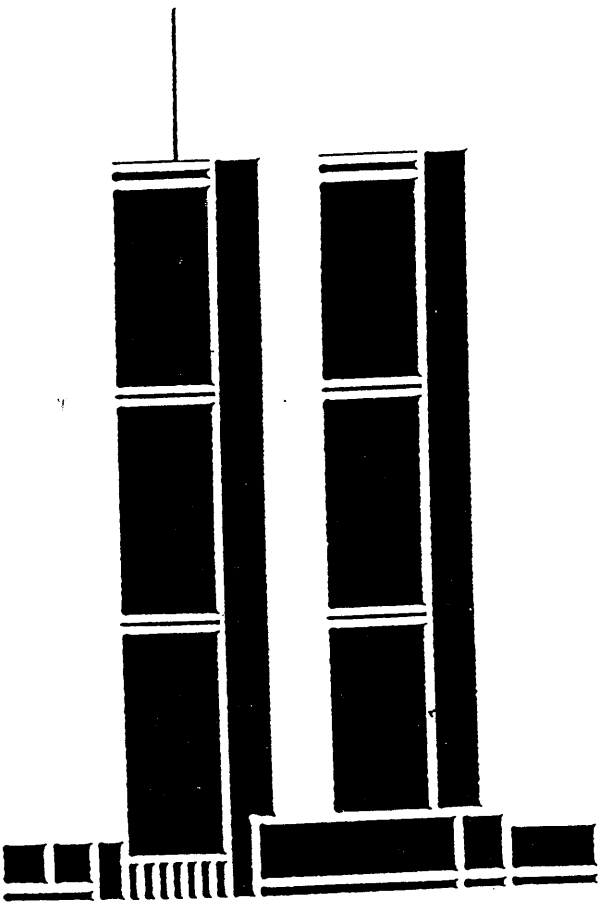
WORLD TRADE CENTER



EMERGENCY PROCEDURES MANUAL

2001

CONFIDENTIAL

INTRODUCTION

Attached is the 2001 version of the World Trade Center Emergency Procedures Manual. This manual outlines response procedures and protocol for World Trade Center Emergency Response Personnel. The original document was prepared in 1988 and has been updated and expanded on an annual basis since.

Each chapter is divided into two sections - "General Information" and "Response". The "General Information" section is subdivided and provides the Scope of the chapter, which summarizes the content and applicability of the procedures; Major Responsibilities, which provides a brief overview of the responsibilities of responding units; and Notifications, which identifies the emergency notifications which must be made by staff. The "Response" section provides detailed instructions and responsibilities to be followed by all responding staff.

It should be noted that this manual contains priority and/or restricted information and is distributed on a "need-to-know" basis to authorized staff having duties associated with emergency response within the World Trade Center. The information contained herein is confidential and as such, appropriate precautions shall be taken to secure this document. It may not be copied, reproduced or distributed without authorization from the Port Authority Life Safety and Security Division.

This manual supersedes all previous copies of the Emergency Procedures Manual and upon receipt of this document, all previous versions must be discarded in an appropriate manner, such as shredding or otherwise destroying.

CONFIDENTIAL

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CHAPTER 1

ASBESTOS CONTAMINATION

CHAPTER 1

ASBESTOS CONTAMINATION

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ASBESTOS CONTAMINATION

1-1.1 SCOPE

This response procedure covers Asbestos Containing Material (ACM) contamination caused by the sudden, unexpected release, or potential release, of asbestos into the atmosphere. Contamination may result from:

- Damaged thermal insulation or fireproofing.
- Fire, flood or explosion damage within an area containing asbestos.

Note: For elevator shaft fireproofing fallout, refer to Chapter 6 for specific procedures.

Where an immediate threat to life and property exists, responding staff shall take initial action as covered in other chapters of this manual and shall consider these asbestos contamination procedures subordinate to overall life safety when stabilizing the initial emergency.

1-1.2 MAJOR RESPONSIBILITIES

Environmental

- Direct and monitor asbestos cleanup for compliance with Port Authority asbestos policies and applicable state and federal regulations. Perform bulk and air sampling and analysis.

Operations and Maintenance Management

- Mechanical Section: Secure all affected mechanical systems.
- Electrical Section: Secure all affected electrical systems.
- General Maintenance Section: Secure all affected structural systems.
- Environmental Coordinator: Assess condition and extent of contamination, determine cleanup procedures, and coordinate the activities of the Environmental Division and abatement contractor.

Construction Division

- Participate as requested by the Environmental Coordinator.

Life Safety and Security

- Authorize and conduct evacuation, monitor fire/life safety concerns and authorize use of security officers to secure contaminated areas.

Operations Control Center

- Coordinate elevator response; initiate appropriate notifications.

Police

- Respond and, as requested by Environmental or other appropriate Units, establish perimeter at point(s) dictated by events and prevent reentry of unauthorized personnel. Contact PATH ESU if needed.

Property Management

- Act as the WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues directly impacting tenants.
- Disseminate information to tenants.

1-1.3 NOTIFICATIONS

The initial report of an asbestos release event shall be made to the Operations Control Center, detailing the precise location, nature and extent of the incident in accordance with Exhibit 1A, contained herein.

All of the notifications, which are to be made by the Operations Control Center Supervisor and the Police Desk Officer, are listed in Exhibit 1B, contained herein.

1-2 RESPONSE

1-2.1 ENVIRONMENTAL

When notified by the WTC Environmental Coordinator:

- Respond to contaminated area and immediately evaluate the extent of contamination. Commence air monitoring inside and outside of affected area(s).
- Assess cleanup process and advise Environmental Coordinator of any required actions beyond those already taken.
- Oversee environmental performance of cleanup contractors.
- Determine if notification must be transmitted to New York State Department of Labor.
- Ensure ACM is disposed of properly (refer to Exhibit 1C).

1-2.2 OPERATIONS AND MAINTENANCE MANAGEMENT

Note: ***Only staff who have been trained to handle asbestos will participate in asbestos contamination emergencies.***

Duty Supervisor

- Personally observe and assess conditions to determine the nature and scope of the potential hazard with the appropriate section supervisory staff (Contract or Port Authority).
- Notify Operations Control Center Supervisor that an actual ACM contamination emergency has occurred and initiate contact with the Environmental Coordinator.
- In the case of contamination in an elevator cab, secure all elevators in common shafts.

If the incident occurs from a flood in open areas:

- For Small Floods, evacuate the immediate area.
- For Medium Floods, evacuate the immediate and surrounding area (10 ft. radius).
- For Large Floods, evacuate the immediate and surrounding area (25 ft. radius).

If the incident occurs from a flood in single occupant office, rest room, janitor closet, etc.:

- Request that occupant(s) evacuate the area and close (lock) the door to keep unauthorized personnel out.
- If the incident occurs from a fire or an explosion, notify the Life Safety and Security supervisor who will direct that the heating, ventilation and air conditioning (HVAC) system be operated on "smoke purge" mode or as directed or approved by the Fire Safety Director, New York City Fire Department Chief Officer in charge and/or the New York City Police Department Bomb Squad.

- Request the Mechanical Section to secure the HVAC supply system to the area and operate fan(s) on full exhaust.

Note: Exhaust systems in toilets and service closets should remain on during clean up.

- If cleanup of the affected area can not be immediately started, direct Operations and Maintenance Management staff to cover the fallout debris with polyethylene sheeting to prevent disturbance by unauthorized personnel.

Direct janitorial services contractor to:

- Respond to the area to contain any water with dikes and to remove it using proper procedures.

- Spread plastic sheeting and secure with duct tape to minimize water damage to furnishings and carpets. Remove all debris from desks - typewriters, telephones, papers, books, computers, etc.

Direct other Operations and Maintenance Management staff to:

- Secure the entry and exit points to affected area to unauthorized personnel.

[redacted]

After repairs and cleaning are completed and clean air monitoring results indicate fiber counts below .01f/cc, area can safely be reoccupied. Barriers must be

- Respond to area, or safe area as directed.
- Secure all affected electrical systems (i.e. light fixtures, smoke detectors, etc.)
- Perform repairs and restore normal services when requested to do so.
- Assist in the cleanup and/or response as directed by the Environmental Coordinator.

General Maintenance Section

Under the direction of the Environmental Coordinator:

- Respond to area, or safe area as directed.
- Secure all affected structural systems - i.e. support sagging ceilings, remove loose ceiling tiles, install temporary polyethylene sheeting in the ceiling, etc.
- Fabricate enclosure to facilitate clean up.
- Assist in the cleanup and/or response as directed by the Environmental Coordinator.

1-2.3 LIFE SAFETY AND SECURITY

Life Safety and Security Supervisor

- Establish a secure area as requested.
- Deploy necessary security personnel to maintain secure perimeter.
- Deploy necessary security personnel to secure evacuated floors/zones and to prevent reoccupancy.
- Monitor crowd control activities.
- Dispatch "key-runs".
- If necessary, issue temporary identification cards to personnel involved in operation.
- Maintain appropriate files.
- Direct evacuation, if necessary.
- Oversee event from fire/life safety standpoint.
- Coordinate all activities with the New York City Fire Department, if necessary.

Operations Control Center

- Initiate all appropriate notifications.
- Information regarding ACM should be referred to as "Code 3".
- Determine if shafts are deemed negative or positive for ACM based on survey information.

Elevator Starter

- Secure all elevators in common shaft and close doors.

- Collect all available information and report same to the Operations Control Center.
- Complete "Fireproofing Fallout Procedures" form.

1-2.4 POLICE

- Assist in evacuation as requested.
- Prevent unauthorized re-entry if requested by Life Safety & Security staff.

1-2.5 CONSTRUCTION DIVISION

- Participate when requested by the Environmental Coordinator.

1-2.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 1A
KEY INFORMATION

To allay unnecessary concern in affected areas, all radio transmissions should refer to "asbestos" as "ACM" (Asbestos Containing Material).

Specifics of Incident	Precise location of incident. Identify type of ACM and incident:
	Thermal Insulation
Exp	losion

EXHIBIT 1B
NOTIFICATIONS

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

Refer to Appendix A for specific names and telephone numbers.

FROM	PRIORITY	TO
OCC	1st	Operations & Maintenance Management Supervisor Life Safety & Security Supervisor Environmental Coordinator Police Desk
	2nd	Security & Life Safety Director Fire Safety Director Manager, Operations & Maintenance Management Supervising Engineer Maintenance Supervisor (General Maintenance) Maintenance Supervisor (Mechanical) Maintenance Supervisor (Electrical) Manager, Vertical Transportation Appropriate General Property Manager Appropriate Senior Property Manager Appropriate Property Manager All individuals listed in "Asbestos Contamination" paging group
Police Desk	1st	Police Supervisor

Note: It is the responsibility of the Environmental Construction Division to notify the New York State Department of Labor and US Environmental Protection Agency whenever significant asbestos contamination occurs.

EXHIBIT 1C
ASBESTOS CLEANING AND DISPOSAL METHODS

Approved Cleaning Methods

1. All decontamination procedures shall include wet-cleaning and/or HEPA (High Efficiency Particulate Absolute) vacuuming.
2. All water from an asbestos work area is considered contaminated and shall be disposed of as such.
3. All surfaces, fixtures, furnishings and equipment in the designated asbestos work area shall be decontaminated through wet-cleaning or damp wiping and/or HEPA vacuuming. Dry-sweeping, dry-dusting or non-HEPA filtered vacuuming is prohibited.
4. All tools and equipment are to be decontaminated before being removed from the work area.

Decontamination Procedures for Tools and Equipment

1. All tools and equipment are to be HEPA vacuumed and/or wet-cleaned before

CHAPTER 2

BOMB THREATS

CHAPTER 2

BOMB THREATS

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BOMB THREATS

2-1.1 SCOPE

This procedure covers the appropriate response to general bomb threats, specific bomb threats, suspicious packages and hazardous devices at the World Trade Center complex.

2-1.2 MAJOR RESPONSIBILITIES

GENERAL THREATS

Police

[redacted]

- Protect life and property
- Protect and preserve scene

[redacted]

- Act as the WTC Liaison Officer.
- Coordinate with Life Safety & Security and Police on issues impacting tenants.
- Disseminate information to tenants.

SPECIFIC THREATS

Police

- Assess situation
- Document incident
- Protect life and property
- Protect and preserve scene

Life Safety and Security

- Confer with Police Officials, present information to WTD Director.
- Deploy necessary security personnel to maintain secure perimeter.
- Coordinate all fire/life safety activities with the New York City Fire Department.
- Authorize use of security officers as required.

Operations and Maintenance Management

- Assist with evacuation if requested.
- Determine risk to nearby utility systems - secure same, if necessary.

New York City Police Department Bomb Squad:

- Make all technical decisions, coordinate activities with Port Authority Police.

New York City Fire Department:

- Respond and operate in precautionary "stand by" mode.
- In the event of fire/explosion, coordinate activities with Fire Safety Director.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with Life Safety & Security and Police on issues impacting tenants.

2-1.3 Notifications

Initial report of a bomb threat will be made to the World Trade Center Police Desk detailing, as much as possible, the type of bomb threat and the information identified in Exhibit 2A. All notifications to be made are listed in Exhibit 2B.

2-2 RESPONSE

2-2.1 POLICE

Note: *All threats should be treated as genuine until it can be established*

- Tenant Areas - Depending on the size of the area, a supervisor will assess staffing needs for search area. Depending on the level of risk, a tenant representative familiar with the area will accompany the police on the search. No civilian(s) will be placed in undue danger.

Suspicious Object Located

- Identify danger area; secure area with a clear zone of at least 1000 feet, including floors above and below the object.
- Depending on the size and location of the object, greater areas of evacuation may be necessary.
- The Police Desk will request the response of the New York City Police Department Bomb Squad and make other necessary notifications.
- The New York City Police Department Bomb Squad may make a determination for larger evacuation area. Such determinations will be coordinated with the Port Authority Police and related WTC Units.

Evacuation

- The ranking police supervisor will evaluate and determine the evacuation scope and size.
- Upon making evacuation decisions, procedures in Exhibit 2C will be followed.

Protection of Life and Property

- Appropriate assistance will be provided to individuals who may have difficulty evacuating the area on their own.
- Evacuations will be done via elevator unless there is potential for the elevator cars to be involved.
- Upon completion of the evacuation, all elevators servicing the affected floor(s) will be secured as required.
- Depending on the circumstances, doors in the immediate vicinity of the object may be opened to minimize primary damage from the blast and secondary damage from fragmentation.

Protection and Preservation of the Scene

- The scene of the incident must be secured as soon as possible.
- Potential evidence must be preserved. It should not be damaged, moved or disposed of.
- Depending on the nature of the incident, several agencies may arrive on site to conduct investigations.
- Accurate notes of events that transpire at the scene must be maintained.

Crowd Control

- Sightseers and bystanders must be kept at a safe distance.
- Officers should maintain control of evacuees, and not allow individuals to return to the area(s) evacuated without clearance from the Incident Commander.
- Areas surrounding the scene should be secured and only authorized individuals allowed access.

Media

- Coordinate with LS&S, O&MM and Property Management to designate an appropriate area for media, press, etc. to gather.
- Notify Port Authority Media Relations.

2-2.2 LIFE SAFETY AND SECURITY

Life Safety and Security Supervisor

- Deploy security personnel to maintain secure perimeter.
- Dispatch "key runs" as necessary.
- Respond to appropriate Fire Command Station and direct use of public address (evacuation) announcements if required.
- Oversee event from fire/life safety standpoint.
- Coordinate all activities with New York City Fire Department as required.

Operations Control Center Supervisor

- Direct appropriate elevator starters/operators to have designated cars standby for emergency use.
- Make appropriate notifications as listed in Exhibit 2B.
- To reduce the anxiety of visitors at public facilities, including Windows on the World and the Top of the World Observation Deck, notification must be made to the Restaurant and Deck Supervisors as appropriate, so they are aware of the facility emergency. This is necessary when emergency response personnel and vehicles respond to the building entrances where they are highly visible.

2-2.3 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

- At the request of Life Safety & Security, assist in evacuation procedures and in keeping unauthorized individuals out of, and away from, the affected area.
- Deploy staff to each lobby and skylobby elevator starter's console.

- Monitor Police communications at the Police Desk, either personally or through a subordinate and relay status of the situation to affected and appropriate civilian staff.

For discovery of a possible device or when an evacuation is necessary:

Mechanical Section

- Advise Operations Control Center and appropriate Fire Command Stations of nearby utility systems.
- Operate fire protection systems (refer to Fire Emergency Chapter).
- Determine need to secure affected mechanical systems and make appropriate recommendations.

Electrical Section

- Advise Operations Control Center and appropriate Fire Command Stations of nearby utility systems.
- Determine the need to secure affected electrical systems and make appropriate recommendations.
- Stand by to operate emergency power systems and provide portable emergency power where needed or requested.

2-2.4 VERTICAL TRANSPORTATION

Elevator Contractor

- Advise Operations Control Center and appropriate Fire Command Stations of nearby elevator shafts and equipment.

2-2.5 NEW YORK CITY POLICE DEPARTMENT BOMB SQUAD

- As requested by PAPD, respond to the scene and take appropriate action.
- Advise Police and Fire/Life Safety if an evacuation is necessary.

2-2.7 NEW YORK CITY FIRE DEPARTMENT

- Respond and initiate appropriate precautionary activities.
- Upon notification of a fire or explosion, respond to the designated location immediately initiating suppression/extinguishment activities.
- Perform associated rescue duties.
- Coordinate activities with the Fire Safety Director.

2-2.8 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 2A
BOMB THREAT CHECKLIST

Date of call: _____ Time of call: _____ Length of call: _____

Sex of caller: _____ Male _____ Female

Exact wording of threat:

_____

_____

_____

_____

_____

If the caller seems agreeable to further conversation ask questions such as

When is the bomb going to explode? _____

Where is the bomb? _____

What does it look like? _____

What kind of bomb is it? _____

What will cause it to explode? _____

Did you place the bomb? _____

Why? _____

Where are you calling from? _____

What is your address? _____

What is your name? _____

Voice characteristics (circle)

Calm	Disguised	Stutter	Slow	Giggling
Deep	Stressed	Accent	Nasal	Angry
Sincere	Lisp	Crying Loud	Squeaky	Slurred
Intoxicated	Broken	Rapid Excited	Normal	Pleasant

If voice is familiar, whom did it sound like? _____

Background noise (circle)

Office	Factory	Animals	Quiet	Street
Traffic	Aircraft	Trains	Boats	Music
Voices	Party atmosphere	Mixed	Other	

Accent (circle)

Local	Foreign	Race	Not local

Person receiving call:_____

Telephone number call received at:_____

Other information:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

REPORT CALL IMMEDIATELY TO WTC POLICE (435-3540)

NOTE: In order to avoid causing unnecessary concern, all radio transmissions should refer to a bomb threat as a "Possible 8-28".

EXHIBIT 2B
NOTIFICATIONS

WARNING: Radio and cellular equipment should not be utilized to communicate near a suspected device since transmission frequencies may cause premature detonation.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

Refer to Appendix A for names and telephone numbers.

STAGE	FROM	TO
Bomb Threat	**Police Desk**	All Police Officers Police Supervisor Tactical Response Bureau Operations Control Center Central Police Desk PATH ESU NYPD 1st Precinct NYPD ESU NYPD Bomb Squad FBI (NYC office)
	OCC	Security Director Security Supervisor LS&S Supervisor Fire Safety Director Manager, Operations & Maintenance Management O&MM Duty Supervisor Appropriate Property Manager Senior Property Manager General Property Manager Supervising Engineer Manager, Vertical Transportation All individuals listed in the "Bomb Threat" paging chapter

STAGE	FROM	TO
Discovery of Possible Device	**Police Desk**	NYPD *and...* FDNY *and...* FDNY Bureau of EMS *and...* Operations Control Center
	OCC	All individuals listed in "Bomb Threat" paging chapter informing that a possible device was found *and...* Security Director Security Supervisor Fire Safety Director Manager, Operations & Maintenance Management Supervising Engineer Manager, Vertical Transportation Appropriate Property Manager(s) Senior Property Manager General Property Manager Supervisor, Electrical Contract Supervisor, Mechanical Contract Supervisor, Structural Contract Supervisor, Elevator Contract

NOTE: If the concourse or the entire complex is to be evacuated, the following must be notified: NYC Transit Authority, PATH, Marriott Hotel, US Customs House, 7 WTC, the World Financial Center and Bankers Trust Building.

EXHIBIT 2C
EVACUATION PROCEDURES

- The time factor for evacuation is one half hour before reported time of detonation to one hour after.
- A floor by floor, word of mouth notification will be the key to an orderly and safe operation. Upon the request of appropriate WTC Management, the Fire Safety Director (or LS&S Supervisor) will direct public address announcements.
- There are three types of evacuation: Localized, Building, or the Entire Complex.

Localized Evacuation:

Office Space:

- Evacuate the entire affected floor as well as one (1) floor above and one (1) floor below (this may be expanded depending on the circumstances).
- Local elevator banks may be used depending on the circumstances.
- Fire Safety Floor Wardens will assist in the search and verify that all persons have been evacuated if there is no personal risk.
- The Police will conduct a secondary search.

Public Areas:

- Identify danger area(s) and maintain a clear radius of at least 1000 feet. Banks, restaurants, etc., require special attention due to glass fragmentation and flying debris. Persons in area should be evacuated quickly to an assembly point distant enough so as not to expose them to risks of a blast.

Building or Entire Complex Evacuation:

When evacuating Buildings One, Two, Four and Five simultaneously, it will be necessary to estimate the amount of staff needed. The Police will, if necessary, request mobilization of other units from the Central Police Desk. The Police will utilize existing WTC Evacuation Procedures and coordinate activities with the Fire Safety Director who will direct appropriate evacuation announcements and activities.

- Partial Evacuation: Evacuation of floors within one zone serviced by one elevator bank.
- Phased Evacuation: Evacuation of all floors within one zone.
- Mass Evacuation: Evacuation of all zones within one building.
- Total Evacuation: Evacuation of all buildings within the complex.

Exhibit 2C Continued...

NOTE: For Building or the Entire Complex Evacuation, assemble evacuees outside the appropriate building as follows:

- 1 WTC: Exit through lobby portals, up the escalators and onto the pedestrian bridge leading to the World Financial Center.
- 2 WTC: Exit to Liberty Street.
- 3 WTC: (Marriott Hotel) Liberty Street (2 WTC), West Street (1 WTC).
- 4 WTC: Elevator Bank "West" exit to Church Street. Elevator Bank "East" exit to Liberty Street.
- 5 WTC: Exit through Vesey Street doors to West Broadway.
- Concourse: Use all exits and refer to Appendix C - Concourse Evacuation.

Refer to Appendix B for maps of the complex.

Police, Security and O&MM staff with "bull horns" should be posted inside and outside each tower facing the greatest concentration of evacuees to make announcements.

CHAPTER 3

CHEMICAL AND FUEL RELEASES

CHAPTER 3

CHEMICAL AND FUEL RELEASES

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3.0 HANDLING AND DISPOSAL PROCEDURES FOR SELECTED HAZARDOUS MATERIALS

The following hazardous materials have been identified as the most frequently encountered on the World Trade Center Truck Docks:

- Gasoline
- Fuel oil/diesel fuel
- Battery acid
- Anti-freeze (or ethylene glycol)
- Liquefied petroleum gas or Propane
- Freon R-22

When considering procedures for handling and disposal of the aforementioned five hazardous materials, the type and size of the incident must be evaluated. The procedures set forth in this section are not intended to instruct facility personnel in handling a major emergency incident such as a fire involving a tanker truck loaded with gasoline or diesel fuel, etc. They are intended to provide instruction in the event of a vehicular accident in which the vehicle fuel tank has ruptured; a truck or car battery has split, releasing battery acid; a radiator has ruptured, causing an anti-freeze spill; or a small (less than 100 pounds) propane cylinder is leaking on a camper or in a vehicle. In situations of such magnitudes, these hazardous materials can be handled safely, if, they are handled correctly.

The potential hazards, emergency actions, handling and disposal procedures for gasoline, fuel oil/diesel fuel, battery acid, anti-freeze (or ethylene glycol), or liquefied petroleum gas or propane are provided in this section.

3.1 GASOLINE (ID #1203)

FIRE OR EXPLOSION

- Gasoline is a flammable liquid that may be ignited by heat, sparks or flames.
- Vapors are heavier than air and may travel to a source of ignition and flash back.
- Containers may explode in heat of fire.
- Run-off to sewers may create fire or explosion hazard.

HEALTH HAZARDS

- Gasoline may be poisonous if inhaled as a liquid or absorbed through the skin.
- Vapors may cause nose and throat irritation, drowsiness, nausea, dizziness or suffocation especially in enclosed spaces, such as the tunnels.
- Gasoline may act as an irritant and cause itching and burning of skin and eyes.

- Moderate eye irritation may be experienced after approximately one hour of exposure.
- If ingested, gasoline causes a burning sensation in the mouth, throat and stomach. Vomiting, diarrhea, drowsiness and intoxication may follow. As little as 3 to 4 ounces may be fatal.
- Fire may produce irritating poisonous gases.
- Run-off from fire control or dilution water may cause pollution.

3.1-1 EMERGENCY ACTION

PERSONAL PROTECTION

- Keep unnecessary people away; isolate the hazard area and deny entry.
- Stay upwind; keep out of low areas.
- Avoid breathing vapors and all bodily contact.
- Wear Self Contained Breathing Apparatus including full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).
- If water pollution occurs, notify the Environmental Coordinator.

FIRE RESPONSE

Small fires involving gasoline are those resulting from vehicular accidents where the quantity is limited. In such instances apply:

1. Purple K (Dry Chemical)
2. Foam
3. Water Fog

Large fires involving gasoline are considered to be any large scale incidents such as a gasoline tank truck fires where the gasoline cargo is, or has, the potential to be involved. In such instances:

1. Call for assistance
2. Evacuate the area, withdraw and deny entry.
3. Proceed with caution.
4. Restrict access to the area.
5. Keep unprotected personnel upwind of the spill area.
6. Avoid contact with the spill material.
7. Eliminate ignition sources; do not permit flares, smoking or flames in the hazard area.
8. Prevent liquid from entering sewers and confined spaces.
9. Protect sewers and waterways from contaminated water run-off with absorbent pillows and pads.
10. Use water fog to reduce vapors.

Small spills involving gasoline are those resulting from a ruptured fuel tank or vehicular accidents where the quantity is limited. In such instances, the material may be soaked up with sand or absorbs and place into 55 gallon drums (DOT-17H) for later disposal.

Large Spills involving gasoline are considered to be any large scale incidents such as a tank truck with a leaking cargo of gasoline. In such instances, dike far ahead of the spill for contaminated blanket with foam from a safe distance. Cleanup and disposal will be carried out by personnel other then WTC staff.

FIRST AID

- Call for emergency medical assistance.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.
- If breathing is difficult, administer oxygen.
- In case of contact with the material, immediately flush eyes with running water for at least 15 minutes. Wash skin with large amounts of soap and water.
- Remove and isolate gasoline contaminated clothing and shoes at the site.

3.2 FUEL OIL / DIESEL FUEL (ID #1993)

FIRE OR EXPLOSION

Fuel oil/diesel fuel is a combustible liquid that may be ignited by heat, sparks or flames. Accumulations of vapors from the heated liquid in confined spaces may result in explosions if ignited. Containers may explode in the heat of a fire. Run-off into sewers or similar confined spaces may create fire or explosion hazard.

HEALTH HAZARDS

- Fuel oil/diesel fuel vapors (in high concentration) may cause headache, slight giddiness, and possible irritation of the eyes, nose, and lungs, especially in enclosed spaces.
- Contact with fuel oils may irritate or cause drying and cracking of the skin.
- Contact with the eyes may result in slight irritation or, in most cases, no injury.
- If ingested, fuel oils may cause nausea, vomiting, cramping and possible central nervous system depression. Aspiration into the lungs during vomiting may result in coughing, gagging, difficulty breathing, etc. with possible severe consequences.
- Fire may produce irritating, toxic smoke.
- Run-off from fire control or dilution water may cause pollution.

3.2-1 EMERGENCY ACTION - PERSONAL PROTECTION

- Keep unnecessary people away; isolate the hazard area and deny entry.
- Stay upwind; keep out of low areas.
- Avoid breathing vapors and all bodily contact.
- Wear Self Contained Breathing Apparatus including full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).
- If water pollution occurs, notify the Environmental Coordinator.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.
- If breathing is difficult, administer oxygen.
- In case of contact with the material, immediately flush eyes with running water for at least 15 minutes. Wash skin with large amounts of soap and water.
- Remove and isolate gasoline contaminated clothing and shoes at the site.

FIRE RESPONSE

Small fires are considered those resulting from vehicular accidents where the quantity is limited. In such instances apply:

1. Purple K (Dry Chemical)
2. Foam
3. Water Fog

Large fires are considered to be any large scale incidents such as a tank truck fire where the cargo is, or has the potential to be, involved. In such instances:

- Call for assistance
- Evacuate the area, withdraw and deny entry.
- Proceed with caution.
- Restrict access to the area.
- Keep unprotected personnel upwind of the spill area.
- Avoid contact with the spill material
- Eliminate ignition sources; do not permit flares, smoking or flames in the hazard area.
- Prevent liquid form entering sewers and confined spaces.
- Protect sewers and waterways from contaminated water run-off with absorbent pillows and pads.
- Use water fog to reduce vapors.

Small spills are those resulting from a ruptured fuel tank or vehicular accidents where the quantity is limited. In such instances, the material may be soaked up with sand or absorbed and place into 55 gallon drums (DOT-17H) for later disposal.

Large Spills are considered to be any large scale incidents such as a tank truck with leaking cargo. In such instances, dikes must be established far ahead of the

spill for containment. Cleanup and disposal will be carried out by personnel other then WTC staff.

FIRST AID

- Call for emergency medical assistance.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.
- If breathing is difficult, administer oxygen.
- In case of contact with the material, immediately flush eyes with running water for at least 15 minutes. Wash skin with large amounts of soap and water.
- Remove and isolate fuel contaminated clothing and shoes at the site.

3.3 BATTERY ACID (ID #2796)

FIRE OR EXPLOSION

- Battery acid is a combustible material that may burn but does not ignite readily.
- Highly corrosive to many metals and bodily tissues.
- Battery acid is a strong oxidizer and a highly reactive substance.
- May ignite other combustible materials (wood, paper, oil, etc.)
- Reacts violently with water.
- Flammable poisonous gases may accumulate in tanks used to transport battery acid.
- Run-off into sewers or similar confined spaces may create a fire or explosion hazard.

HEALTH HAZARDS

- Poisonous if inhaled or swallowed.
- If ingested, battery acid may cause burns of the mouth and throat and cause other severe consequences.
- Contact with skin or eyes causes sever burns.
- Fumes and mists may cause irritation of the eyes, nose, throat and respiratory tract.
- Run-off from fire control or dilution water may cause pollution.

3.3-1 EMERGENCY ACTION

PERSONAL PROTECTION

- Keep unnecessary people away; isolate the hazard area and deny entry.
- Stay upwind; keep out of low areas.
- Avoid breathing vapors and all bodily contact.

- Ventilate closed spaces before entering them.
- Wear Self Contained Breathing Apparatus including mask and full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).
- If water pollution occurs, notify the Environmental Coordinator.

FIRE RESPONSE

DO NOT GET WATER INSIDE CONTAINERS OF BATTERY ACID.

Small fires are considered those resulting from vehicular accidents where the quantity is limited. In such instances apply:

- Purple K (Dry Chemical)
- Water in flooding quantities as fog or spray.

Large fires are considered to be any large scale incidents such as a tank truck fire where the cargo is, or has the potential, to be involved. In such instances:

- Call for assistance.
- Evacuate the area, withdraw and deny entry.
- Stay upwind.

SPILL OR LEAK RESPONSE

- Proceed with caution.
- Restrict access to the area.
- Keep unprotected personnel upwind of the spill area.
- Avoid contact with the spill material (do not touch the spilled material).
- Prevent liquid form entering sewers and confined spaces.
- Protect sewers and waterways from contaminated water run-off with absorbent pillows and pads.
- Take into account while planning the response, that battery acid is corrosive and reactive.
- Use water fog to reduce vapors but do not put water directly on the leak or spill area.

Small Spills involving battery acid are those resulting from vehicular accidents where the quantity is limited. In such instances, dike the spill with sand or absorbent material neutralize contained battery acid with soda ash; do not apply water. Place collected material into 55 gallon drums (DOT-17H) for later disposal.

Large Spills involving battery acid are considered to be any large scale incidents such as a leaking drum or tank trucks loaded with battery acid that are leaking. In such instances, dike far ahead of the spill for containment using sand or absorbent material. Evacuate the area, withdraw and deny entry. Cleanup and disposal will be carried out by personnel other then WTC staff.

FIRST AID

- Call for emergency medical assistance.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.
- If breathing is difficult, administer oxygen.
- Speed in removing the material from the skin is of extreme importance.
- In case of contact with the material, immediately flush the affected area with large amounts of water.
- In case the material contacts the eyes, immediately flush the eyes with water for at least 15 minutes occasionally lifting the eyelids; immediately obtain emergency medical assistance.
- Remove and isolate battery acid contaminated clothing and shoes at the site; place in 55 gallon drums (DOT-17H) for disposal.

3.4 ANTI-FREEZE (ID #1142)

FIRE OR EXPLOSION

- Anti-freeze is also known as ethylene glycol. It can be a flammable or combustible material and may be ignited by heat, sparks or flames.
- Vapors may travel to a source of ignition and flash back.
- Containers may explode in the heat of a fire.
- Vapor explosion hazard indoors, or outdoors in sewers or similar confined spaces.
- Run-off into sewers or similar drainage structures may create fire or explosion hazard.

HEALTH HAZARDS

- Anti-freeze may be poisonous if inhaled, ingested, or absorbed through the skin.
- Vapors may cause dizziness or suffocation especially in enclosed spaces such as tunnels
- If ingested, Anti-freeze may cause intoxication, 3-4 ounces may fatal.
- Fire may produce irritating or poisonous gases.
- Run-off from fire control or dilution water may cause pollution.

3.4-1 EMERGENCY ACTION

PERSONAL PROTECTION

- Keep unnecessary people away; isolate the hazard area and deny entry.
- Stay upwind; keep out of low area, avoid breathing vapors and all bodily contact.

- Wear Self Contained Breathing Apparatus including mask and full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).
- If water pollution occurs, notify the Environmental Coordinator.

FIRE RESPONSE

Small fires involving anti-freeze or ethylene glycol are considered those resulting from vehicular accidents. In such instances apply:

- Purple K (Dry Chemical)
- Water Fog

Large fires involving anti-freeze or ethylene glycol are considered to be any large scale incidents such as drum or tank trucks loaded with anti-freeze that are involved in a fire. In such instances:

- Call for assistance
- Evacuate the area, withdraw and deny entry.

SPILL OR LEAK RESPONSE

- Proceed with caution.
- Restrict access to the area.
- Keep unprotected personnel upwind of the spill area.
- Avoid contact with the spill material.
- Eliminate ignition sources; do not permit flares, smoking or flames in the hazard area.
- Prevent liquid form entering sewers and confined spaces.
- Protect sewers and waterways from contaminated water run-off with absorbent pillows and pads.
- Use water fog to reduce vapors.

Small spills of anti-freeze or ethylene glycol are those resulting from vehicular accident in which the quantity is limited. In such instances, soak up with sand or absorb and dispose.
Large spills involving anti-freeze or ethylene glycol are considered to be any large scale incidents such as a those involving leaking shipments of anti-freeze or ethylene glycol in drums or other shipping containers. In such instances, dike far ahead of the spill for containment. Cleanup and disposal will be carried out by personnel other then WTC staff.

FIRST AID

- Call for emergency medical assistance.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.

- If breathing is difficult, administer oxygen
- In case of contact with the material, immediately flush eyes with running water for at least 15 minutes.
- In case of skin contact, rinse the area with water; then wash with soap and water.
- Remove and isolate anti-freeze contaminated clothing and shoes at the site.

3.5 LIQUEFIED PETROLEUM GAS [LPG] (ID #1075) AND PROPANE (ID #1978)

FIRE OR EXPLOSION

- Liquefied petroleum gas (LPG) and propane are extremely flammable gases which may be ignited by heat, sparks or flames.
- Vapors of LPG and propane are heavier than air and may travel to a source of ignition and flash back.
- LPG or propane fires burn hotter and noisier than most fires.
- Containers may explode in the heat of a fire.
- Vapor explosion hazard exists indoors or outdoors in sewers and similar drainage structures.
- When the material is involved in a fire condition the containment cylinder, tank, or tank car may violently rupture and "rocket".

HEALTH HAZARDS

- Vapors of LPG or propane may cause dizziness, drowsiness, unconsciousness, or suffocation; can asphyxiate by the displacement of air. Contact with liquid LPG or propane may cause frostbite as well as skin and eye irritation.

PERSONAL PROTECTION

- Keep unnecessary people away; isolate the hazard area and deny entry.
- Stay upwind; keep out of low area.
- Avoid breathing vapors and all bodily contact.
- Wear Self Contained Breathing Apparatus including full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).

FIRE RESPONSE

Small fires involving LPG or propane are those that involve cylinders of 100 lb. capacity or less such as those that may be carried on the outside of campers or recreational vehicles.
In such instances apply:

- Purple K (Dry Chemical)

- Water Fog
- Foam

OTHER RESPONSE INFORMATION

- Approach any LPG or propane fire with the wind at your back.
- Keep all persons out of the vapor cloud area.
- Eliminate ignition sources; do not permit flares, smoking or flames in the hazard area.
- STAY AWAY FROM THE ENDS OF THE CYLINDERS.
- When LPG or propane are involved in a fire condition, cylinders or tanks may violently rupture.
- Apply Purple K, water fog or foam while facing the side of the container.
- Remember that LPG and propane are heavier than hair.
- Control of the cylinder is the first objective, not extinguishing the fire.
- Gain control by keeping the cylinder cool and shutting off the source of the fuel.
- Most small LPG or propane fires can be controlled if there is ample water available. Use water to keep the cylinder cool and to dissipate any unburned fuel.
- Approach the cylinder to close the shutoff valve behind a water fog. Keep the fog spray level as you approach he cylinder. Leave the container in the same way, behind the safety of a water fog.
- The shutoff valve closes just like a water faucet - turn it clockwise for "off".
- Unburned fuel can present a danger if not dissipated. Continue to wash down area even after the fire is extinguished. Carefully check and wash down all low areas such as sewers or similar drainage systems.
- Cleanup is vital to prevent a second fire, which has the potential to be worse than the first.

NOTE: Some LPG or propane fires, due to their location, lack of adequate water and certain other conditions, cannot be controlled. In such instances, CALL FOR ASSISTANCE. Evacuate the area, withdraw and deny entry.
Large fires involving LPG or propane are those that involve cylinders of 100 lb. capacity or more. For instance, the cargo of a tank truck loaded with LPG or propane or shipments of LPG or propane greater than a 100 lb. cylinder.
In such instances:

- Call for assistance
- Evacuate the area, withdraw and deny entry.
- STAY AWAY FROM THE ENDS OF THE CYLINDERS OR TANKS.
- Under fire conditions, cylinders or tanks may violently rupture.
- Isolate the area for 1/2 mile in all directions if a tank truck is involved in a fire.
- Eliminate ignition sources; do not permit flares, smoking or flames in the hazard area. Explosion may result if vapors are ignited in confined areas

(such as the tunnels). Take into account the extremely volatile and flammable nature of LPG and propane when planning the response.

- Beware of possible heavy gas accumulations in low areas, especially in confined areas.
- Use water fog to reduce vapors and fumes.
- Consult qualified experts for assistance.

FIRST AID

- Call for emergency medical assistance.
- If inhaled, move victim to fresh air; keep warm and at rest.
- If in respiratory distress, administer rescue breathing.
- If breathing is difficult, administer oxygen.
- In case of contact with eyes, immediately flush eyes with running water for at least 15 minutes occasionally lifting the eyelids.
- Remove and isolate liquefied petroleum gas (LPG) and propane contaminated clothing and shoes at the site.

3.6 FREON R-22

FIRE OR EXPLOSION

Freon R-22 is a colorless and nonflammable material that has slight ethereal odor.

HEALTH HAZARDS

Vaporization of excessive amounts of this product can deplete or replace oxygen necessary for breathing. It may cause light-headedness and giddiness. In confined/enclosed spaces or areas with ventilation, Freon R-22 may be hazardous to health. Exposure to concentration of this product may induce cardiac arrhythmia in some individuals.

3.6-1 EMERGENCY ACTION

PERSONAL PROTECTION

When handling liquid, have gloves and eye protection. Use air mask with independent air supply in high concentrations.

SPILL OR LEAK RESPONSE

Ventilate area, especially low places where heavy vapors might collect. Remove open flames.

FIRST AID

If inhaled, remove to fresh air, call a physician. Do not give epinephrine or similar medication. In case of skin or eye contact with the material, flush with water.

SPECIAL PRECAUTIONS

Store containers in a clean, dry area. Do not heat above 125°F.

SPECIFIC PRECAUTIONS

In the event of a major refrigeration leak to the atmosphere in the Central Refrigeration Plant (B-5) or the Auxiliary Refrigeration Plant (B-6), evacuate area and report the location & size of leak to the OCC desk. Re-entry to the space by emergency responders should be made utilizing Self Contained Breathing Apparatus and with instruments to measure oxygen levels

3.7 SODIUM HYPERCHLORITE

HEALTH HAZARDS

- Inhalation:
- Fumes from spill are very irritating to mucous membranes.
- Very little hazard from properly stored solution.
- Skin Contact:
- Irritant, reddening of skin, skin damage.
- Eye Contact:
- Severe irritation.
- Ingestion:
- Causes irritation of membranes of the mouth, throat, and stomach pain and possible ulceration.

FIRE AND EXPLOSION

- Flashpoint: Nonflammable.
- Special Fire Fighting Procedures: Avoid fumes from spilled or exposed liquid, dilute copiously, ventilate, and be prepared to use respiratory protection if needed. Acid contamination will produce very irritating fumes similar to chlorine gas.
- Unusual Fire And Explosion Hazards: Bleach decomposes when heated; decomposition products may cause containers to rupture or explode. Vigorous reaction possible with organic materials or oxidizing agents; may result in a fire.

SPILL OR LEAK RESPONSE

- Waste Disposal Method: Reduce with chemicals listed below. Keep on alkaline side and dilute with copious quantities of water. Main end product is salt water (NaCL).
- Handling Spills: Flush with water to dilute as much as possible, avoid heat and contamination with acid materials. Do not use combustible materials such as sawdust to absorb hypochlorite. Neutralizing Chemicals: Reducing agents such as bisulfites or ferrous salt solutions; some heat will be produced.

3.7-1 EMERGENCY ACTION

FIRST AID

- Eyes: Copious eye wash with water for at least 15 minutes. Consult an eye specialist immediately.
- Inhalation: Remove person to fresh air.
- Ingestion: If accidentally swallowed, drink water, milk and obtain medical attention. DO NOT USE BAKING SODA OR ACIDIC ANTIDOTES.

SPECIAL PRECAUTIONS

- Ventilation: No special ventilation required unless bleach is exposed to decomposition condition; i.e., spills or acidic conditions.
- Respiratory: When fumes are present use NIOSH approved respirator with acid type canister.
- Eyes: Use goggles when dispensing solutions stronger than household bleach (7%).
- Gloves: Use rubber or plastic gloves when exposed to solutions stronger than household bleach (7%).

4.0 HANDLING AND DISPOSAL PROCEDURES FOR ALTERNATE FUELED VEHICLES

This exhibit contains guidelines and procedures to be used if a leak of fire is encountered on an alternate fueled vehicle. Vehicles may be fueled by compressed natural gas or methanol. These instructions are for handling of fires/leaks when methanol or Compressed Natural Gas is used as a vehicle fuel and not as cargo.

4.1 COMPRESSED NATURAL GAS FUELED VEHICLES

Compressed Natural Gas (CNG) fueled vehicles are duel fueled and use CNG and gasoline alternately. They will have dual storage tanks, CNG and gasoline.

CNG vehicles are marked by a diamond shaped symbol with CNG written on the label with white lettering. The vehicle may also be marked by a New York State DOT label or a flammable label.

Natural gas is a flammable, non-toxic, and lighter than air product. The following should be noted for CNG fueled vehicles:

- They may have more than one cylinder
- Manual shutoff valves can be in different locations
- Valves are not required to be color coded, this depends upon the size and style of the vehicle.

CNG tanks are equipped with pressure relief devices. They have combination rupture disc/fusible plugs which activate at a pressure of 5000 psi. Release of the pressure relief valve releases the CNG in the cylinder.

PERSONAL PROTECTION

- Wear Self Contained Breathing Apparatus including full protective clothing (helmet, bunker pants, bunker coat, fire boots and fire gloves).
- Keep unnecessary people away; isolate hazard area, and deny entry.
- Stay upwind, keep out of low areas.

ENGINE COMPARTMENT FIRE

- Turn off the manual shut-off valve, (clockwise 1/4 turn) to shut off the CNG supply to the engine. Follow standard operating procedure for extinguishing engine and ignition fires. The flow of natural gas should shut off when the engine stops or when the supply is shut off. If the natural gas cannot shut off and is burning, allow the natural gas to burn and protect the exposure.

LEAKS

- Evacuate immediate area downwind.
- Eliminate all ignition sources.
- Shut off the engine ignition switch and turn off the MANUAL SHUTOFF VALVE (clockwise 1/4 turn) to shut off the CNG supply to the engine. If the manual shutoff valve cannot be located or does not operate, shut off the supply by turning the individual tank(s) valves clockwise.

TANK COMPARTMENT FIRE

- If tank is exposed to fire, cool with a fog stream and shut off the manual shut-off valve or the individual tank valve(s) (turn clockwise).
- If the tank is not accessible, or if the pressure relief valves have opened, use the fog stream to protect exposures and allow the natural gas to burn at vents.

NOTE:

If the pressure relief valve has activated it will not reset and all the gas from the cylinder will be released. Once activated, the flow cannot be stopped by turning off the manual shutoff valve or the individual cylinder valves.

4.2 METHANOL FUELED VEHICLES

Unlike CNG vehicles, Methanol fueled vehicles are fueled by methanol only. Methanol is a poisonous chemical that can affect the body acutely and chronically through inhalation, ingestion, or repeated or prolonged skin absorption.

Methanol fueled vehicles are marked with a Methanol Fueled Vehicle Label and buses are identified by lettering on the front, rear, and both sides as "methanol powered".

4.2-1 POTENTIAL HAZARDS OF METHANOL (ID #123)

- Methanol is a highly flammable liquid with a flash point of 54 degrees F.
- Methanol is soluble in liquid.
- Methanol vapors are slightly heavier than air and will flow along the ground collecting in low areas.
- Methanol burns clearly (little smoke) and its pale blue flame may be difficult to see in bright sunlight.

HEALTH HAZARD

- Methanol is both an eye and skin irritant.
- Inhalation of vapor concentration can produce drunkenness, drowsiness, blurred vision and unconsciousness or death.
- The effects of methanol exposure may be delayed 24 hours or longer.

PERSONAL PROTECTION

- Wear Self Contained Breathing Apparatus and full protective clothing.
- Keep unnecessary people away; isolate hazard area, and deny entry.
- Stay upwind, keep out of low areas.

SPILL OR LEAKS

- Eliminate ignition sources in the immediate area and downwind of the spill.
- Evacuate area:
- down wind
- where the life hazard is the greatest
- expand evacuation as necessary
- Approach from upwind.

- Use fog stream to channel the vapors away from possible ignition sources. Since methanol is soluble in water, a fog stream will absorb and dilute methanol vapors. To be most effective, apply fog stream down wind of spill.
- Dike spills with sand, dirt or other materials.
- Keep the spill as cool as possible.
- Blanket pools of liquid with alcohol foam to inhibit vapor generation.

FIRES

METHANOL IS DESTRUCTIVE TO ORDINARY FOAM. ALCOHOL-TYPE FOAM MUST BE USED.

For small fires, Type B dry chemical extinguishers are adequate. Purple K is the most effective form of the dry chemical extinguishing agents. Most methanol fueled buses are equipped with a Purple K extinguisher, which is usually located in the area of the operator's seat.

Application of large amounts of water will dilute the methanol, rendering it nonflammable, therefore, adequate water supply must be available. Run-off should be contained by dikeing or other means to-prevent entry into sewers and to assist in the dilution.

NOTE: A methanol fire may be invisible during daylight hours or in bright light.

CHEMICAL AND FUEL RELEASES

3-1 GENERAL INFORMATION

3-1.1 Scope

This procedure covers the response to a hazardous chemical and/or fuel leak. Also included is a section on Hazardous Materials Awareness, which provides essential information in dealing with chemical and related emergencies.

Without the proper training or equipment, aggressive action has no place at a chemical spill incident and will only lead to unnecessary exposure of personnel. There may be situations where, due to the nature of the chemical, the proper action may be no action other than to evacuate the affected area.

Immediate action must be taken during a fuel leak. The important actions during a fuel emergency involve the evacuation of affected areas, the elimination of potential ignition sources and the ventilation the area.

3-1.2 MAJOR RESPONSIBILITIES

Environmental Coordinator

- Evaluate nature and extent of environmental and response worker hazards.
- Initiate appropriate containment and control measures, coordinate with staff departments and regulatory agencies.

Life Safety and Security

- Deploy necessary security personnel to maintain secure perimeter.
- Monitor crowd control activities.
- Authorize use of "key runs".
- Coordinate all fire/life safety activities with the New York City Fire Department.
- Evaluate fire/life safety hazards.
- Direct public address announcements, if required.
- Arrange for emergency elevator service.
- Initiate appropriate notifications.

Police

- Respond to scene.
- If necessary, have Fire Brigade "stand by".
- If necessary, contact PATH ESU.
- Make notifications and prevent unauthorized access to the affected areas.

New York City Fire Department Hazardous Materials Unit

- Make all technical decisions and advise all appropriate units.

Operations and Maintenance Management

- Assist with evacuations when requested.
- Assist with defensive spill control procedures when requested.
- At the request of the Environmental Coordinator or Fire Safety Director, the Mechanical Section will remotely operate ventilation and exhaust systems as directed to prevent accumulations of vapors.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues impacting tenants.
- Disseminate information to tenants as appropriate.

3-1.3 NOTIFICATIONS

Initial reports of a chemical and/or fuel leak will either be made to the Operations Control Center or the Police Desk, identifying the condition and location of the spill, the presence of fire, smoke, fumes, pools of liquid, etc. as well as any other pertinent information.

All notifications, listed in Exhibit 3A, are made by the Operations Control Center Supervisor, the Police Desk Officer and the Environmental Coordinator.

EXHIBIT 3A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TO
OCC	Police Desk Life Safety and Security Supervisor Environmental Coordinator Fire Safety Director Security & Life Safety Director Manager, Operations & Maintenance Management Supervising Engineer O&MM Duty Supervisor Supervisor, Mechanical Contractor Supervisor, Electrical Contractor Appropriate Property Manager(s) Appropriate Senior Property Manager Appropriate General Property Manager All individuals listed in "Chemical Release" paging chapter
Police Desk	Operations Control Center Police Supervisor New York City Fire Department Emergency Medical Services Central Police Desk Environmental Coordinator Fire Safety Director Life Safety & Security Supervisor

EXHIBIT 3A
NOTIFICATIONS

CONTINUED

FROM	TO
Environmental Coordinator	Life Safety & Security Personnel Police Desk Risk Management Division EPA National Response Center New York State DEC New York City DEP Facility Haz-Mat Response Team

3-2 RESPONSE

3-2.1 ENVIRONMENTAL COORDINATOR

Note: ***During off-hours, the Life Safety and Security Supervisor assumes the role and responsibilities of the Environmental Coordinator.***

- Ensure that protective clothing and equipment are utilized by all responding personnel.
- Attempt to identify the chemical and/or fuel involved by looking for any visible placards, labels, chemical or fuel names, identification numbers, symbols, information on the container, tank, drum, vehicle or published references.
- In conjunction with the Fire Safety Director and Police supervisor, and based on regulatory and technical guidelines, determine what actions will be taken to contain the leak or spill.
- Depending on the degree of imminent danger, order an evacuation of the affected area.
- Direct the Mechanical Section to remotely operate ventilation & exhaust systems to prevent an accumulation of vapors.
- Ensure that no chemical or fuel will be disposed of without the direction and advice of the New York City Fire Department Hazardous Materials Unit and Port Authority Environmental Management Division Hazardous Materials Unit.
- Upon consultation with the Manager, Operations & Maintenance Management, Supervising Engineer and Fire Safety Director, make notifications to the Environmental Protection Agency National Response Center and the New York State Department of Environmental Conservation as necessary.
- Insure proper collection and disposal procedures, in accordance with federal and state guidelines, are followed.

3-2.2 LIFE SAFETY AND SECURITY

Fire Safety Director
(Life Safety and Security Supervisor during off-hours)

- Respond and oversee event from a fire/life safety standpoint.
- Direct evacuation if required.
- Direct use of public address announcements if required.
- Coordinate all activities with New York City Fire Department and New York City Fire Department Hazardous Materials Units.
- Deploy necessary security personnel to maintain secure perimeter.
- Deploy necessary security personnel to secure evacuated areas, floors, zones, etc. to prevent unauthorized access or reoccupancy.
- Monitor crowd control activities.
- Dispatch "key-runs" as necessary.

Operations Control Center

- Upon receipt of the initial report of a chemical and/or gas leak, immediately make all appropriate notifications listed in Exhibit 3A.
- Direct the appropriate elevator operators to have certain elevators on "standby" for emergency use by various response units.
- If requested by the Life Safety & Security Supervisor or the Environmental Coordinator, direct elevator operators not to stop on the affected floor(s).

3-2.3 POLICE

Desk Officer

Initiate notification process using the information provided by the Environmental Coordinator concerning the specifics of the chemical and/or leak.

Supervisor

- Respond to the affected area with personal protective equipment and ensure that all Police personnel utilize proper personal protective equipment.
- Depending on the degree of danger, coordinate evacuation of the affected area with Fire Safety Director and Environment al Coordinator.
- Assign Police personnel to ensure the affected area is isolated and to prevent unauthorized entry.
- Attempt to identify the chemical and/or fuel involved.
- Consult with the Environmental Coordinator and Fire Safety Director to determine the need to notify New York City Fire Department.

3-2.4 OPERATIONS and MAINTENANCE MANAGEMENT

- As requested, assign personnel to assist in containing the chemical and/or gas leak utilizing proper protective clothing and equipment, if such a response can be performed safely.
- At the request of the Environmental Coordinator or Fire Safety Director, the Mechanical Section will remotely operate ventilation and exhaust systems as directed to prevent accumulation of vapors.

3-2.5 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.

- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 3B
HAZARDOUS MATERIALS AWARENESS

1.0 General Response Precautions
2.0 Identification of Hazardous Materials
2.1 General Procedures
2.2 Hazardous Material Classifications
2.3 Combustible Liquids
2.4 Compressed Gas
2.5 Corrosive Materials
2.6 Explosives
2.7 Flammable Liquids
2.8 Flammable Solids
2.9 Oxidizing Materials
2.10 Poisons
2.11 Radioactive Materials
2.12 Other Related Materials
3.0 Handling and Disposal Procedures For Selected Hazardous Materials
3.1 Potential Hazards of Gasoline ID #1203
3.1-1 Emergency Action
3.2 Potential Hazards of Fuel Oil/Diesel Fuel ID #1993
3.2-1 Emergency Action
3.3 Potential Hazards of Battery Fluid, Acid ID #2796
3.3-1 Emergency Action
3.4 Potential Hazards of Anti-Freeze ID #1142
3.4-1 Emergency Action
3.5 Potential Hazards Liquefied Petroleum Gas (LPG) ID #1075 And Propane ID #1978
3.6 Potential Hazards of Freon R-22
3.6-1 Emergency Action
3.7 Potential Hazards of Sodium Hypochlorite
3.7-1 Emergency Action
4.0 Handling and Disposal Procedures For Alternate Fueled Vehicles
4.1 Compressed Natural Gas Fueled Vehicles
4.2 Methanol Fueled Vehicles
4.2-1 Potential Hazards of Methanol ID #1230
5.0 Hazardous Materials Locations at WTC

HAZARDOUS MATERIALS AWARENESS

The role of any World Trade Center responder to a hazardous materials incident will be limited to **preliminary identification, communications, possible evacuation and isolation of the affected area.**

It is essential that all responders be aware of the potential danger of dealing with hazardous materials. The information in this exhibit should be used merely as a guideline toward a chemical spill response.

GENERAL RESPONSE PRECAUTIONS

Water is frequently used to flush spills and to control vapors in spill situations. However, a number of hazardous materials can react violently or even explode when exposed to water. In these cases, a burning fire or a spill might be better left alone until expert advice can be obtained. Such advice is necessary since:

1. The use of water may cause a violent reaction or explosion depending on the materials involved.
2. Water may be needed to cool adjoining containers to prevent rupturing (exploding) or the further spread of the fire.
3. Water may be effective in mitigating an incident involving a water-reactive material only if it can be applied at a sufficient "flooding" rate.
4. Depending on the materials involved, the reaction with water may allow them to become more toxic, corrosive or undesirable than if water had not been applied.

When responding to incidents involving water-reactive chemicals, conditions such as wind, precipitation, location and accessibility to the incident as well as the availability of other agents to control the fire and spill must be considered. Because of the great number of variables, the decision to use water on fires or spills involving these water-reactive materials should only be made by an authoritative source, generally, the New York City Fire Department.

Ignition sources are particularly dangerous near flammable vapors that are heavier than air because they tend to flow along the ground, following ground depressions and pooling in low areas. Therefore, they may be ignited a distance from the source causing a "flashback". For example, this may occur if vapors remain in plumbing connections following improper chemical disposal in sewers or drains.

The recommendation to secure the leak when no risk is involved will be determined by the authority in charge. The precaution to "keep upwind" is used for those chemicals whose vapors are toxic or highly irritating. If a flammable liquid is substantially soluble in water and is not highly toxic, the area may be flushed with water spray.

CHAPTER 4

COOLING SYSTEM FAILURES

CHAPTER 4

COOLING SYSTEM FAILURES

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Life Safety and Security	4-2.3

COOLING SYSTEM FAILURES

4-1 GENERAL INFORMATION

4-1.1 SCOPE

This procedure covers procedures for one, or more, cooling system failures caused by pump failure, high water temperatures, ruptured pipes, etc. for the following cooling systems:

- River Water
- Chilled Water
- Condenser Water

4-1.2 MAJOR RESPONSIBILITIES

Operations and Maintenance Management

- Make all response notifications.
- Mechanical Section: Verify that a cooling system failure has in fact occurred and initiate restoration of all affected cooling systems. For "System One" condenser water outages, provide emergency condenser water service.
- Electrical Section: Restore all affected electrical systems. For "System One" condenser water outages, operate Emergency Generator Plant.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with Operations & Maintenance Management on issues directly impacting tenants.
- Disseminate information to appropriate tenants.

Life Safety and Security

- Notify appropriate staff via paging systems as requested.
- Notify New York City Fire Department, if necessary.
- Post security officers, if necessary.

4-1.3 NOTIFICATIONS

The initial report of a cooling system failure will be made to the Operations Control Center, identifying the affected system and any unusual conditions.

All notifications are to be made by the Operations Control Center and are listed in Exhibit 4A.

EXHIBIT 4A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TO
OCC	Supervisor, Mechanical Contractor Supervisor, Electrical Contractor Port Authority Mechanical Supervisor(s) Manager, Operations & Maintenance Management Supervising Engineer Appropriate Property Manager Appropriate Senior Property Manager Appropriate General Property Manager Fire Safety Director Life Safety & Security Supervisor Affected Condenser Water Tenants (off-hours only) All individuals listed in "Cooling Systems Failure" paging chapter
Property Management	**Affected Tenants**

4-2 RESPONSE

4-2.1 OPERATIONS and MAINTENANCE MANAGEMENT

- Receive report of possible cooling system failure.
- Request Mechanical Contractor Supervisor to determine whether a cooling system failure has actually occurred.
- In case of a verified cooling system failure, request that the Operations Control Center makes all notifications listed in Exhibit 4A.

Mechanical Section

- Respond to the affected cooling system room to determine whether an actual failure has occurred, based on the following standards:

Condenser Water

- Any condenser water system flow interruption.
- Any condenser water supply temperature in excess of 10 degrees above designed limits, namely:
* 90 degrees F on primary.
* 95 degrees F on secondary.
* 100 degrees F on tertiary.

Chilled Water

- Any chilled water flow interruption.
- Any chilled water supply temperature in excess of 50 degrees F

emergency power). Then, perform the following within the next one half hour period:

- Swing river water heat exchanger to domestic water cooling.
- Reposition valves as indicated via the Emergency River Water Control Panel in the Central Refrigeration Plant Control Booth.
- Activate one or both Emergency River Water Pumps on emergency power.

During the next hour:

- Physically verify that all valves, strainers, heat exchangers, and pumps are functioning properly and swing over Condenser Water System 1 from domestic water to river water.
- Keep the Operations Control Center and the Manager, Operations and Maintenance Management informed of the probable and actual restoration times.
- Coordinate service restoration with Property Management staff.

Electrical Section

1. Respond to the affected condenser water room to evaluate to assist the Mechanical Section in the restoration of service.
2. For System 1 outages only, ensure that ATS (Automatic Transfer Switch), which serves Condenser Water System 1, loads served by the Emergency River Water Control Panel in the Central Refrigeration Plant Control Booth and the River Water Pump Station, have switched to emergency power.
3. Operate Emergency Generator Plant.

4-2.2 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.

[redacted]

Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.

- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

4-2.3 LIFE SAFETY and SECURITY

- The Operations Control Center will receive reports of possible cooling system failures and notifiy appropriate staff via paging system.
- Request the Mechanical Contractor Supervisor determine whether a cooling system failure has actually occurred.
- In case of a verified cooling system failure, make all notifications listed in Exhibit 4A.
- Notify New York City Fire Department if directed to do so.
- Post security officers if necessary.

CHAPTER 5

DOMESTIC WATER OUTAGES

CHAPTER 5

DOMESTIC WATER OUTAGES

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Life Safety and Security	5-2.3

DOMESTIC WATER OUTAGES

5-1 GENERAL INFORMATION

5-1.1 SCOPE

This procedure covers unscheduled domestic water outages (generally IKOR pump station failures) affecting all domestic water service in one or more buildings or zones.

5-1.2 RESPONSIBILITIES

Operations and Maintenance Management

- Make all response notifications.
- Mechanical Section: Respond to pumping stations in affected tower to verify that an actual outage has occurred, notify the Operations Control Center and restore normal water service.
- Electrical Section: Respond to pumping stations in affected tower and restore all affected electrical systems.

Property Management

- Act as WTC Liaison Officer
- Disseminate information to affected tenants.

Life Safety and Security

- Notify appropriate staff via paging systems as required.
- Notify New York City Fire Department, if necessary

EXHIBIT 5A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs during off-hours.

FROM	TO
OCC	Supervisor, Electrical Contractor Supervisor, Mechanical Contractor Port Authority Mechanical Supervisor(s) Manager, Operations & Maintenance Management OM&M Duty Supervisor Life Safety & Security Supervisor *Appropriate Property Manager *Appropriate Senior Property Manager *Appropriate General Property Manager *Fire Safety Director All individuals listed in "Domestic Water Outage" paging group
Property Management	**Affected Tenants**

* During "off hours", make these notifications only when outages exceed, or may exceed, one hour.

5-2 RESPONSE

5-2.1 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

- If requested, direct staff to secure and clean any areas where water or other damage has occurred.
- Assist Mechanical and/or Electrical Sections when necessary.

Mechanical Section

- Dispatch one mechanic to each pump station in the affected tower. Mechanical Contract Supervisor and Port Authority Maintenance Supervisor(s) should respond to lowest pump station affected.
- Notify appropriate Property Management staff and Manager, Operations & Maintenance Management of affected floors and probable length of outage.
- Monitor pump performance and water flow at each affected pump station.
- Vent air from system and pumps as needed.
- Determine the cause of the shutdown to prevent recurrence.
- Perform necessary repairs.
- Dispatch contract staff to each zone affected by the shutdown to secure and/or repair running flushometers (all restrooms).
- Continuously update Property Management staff and the Manager, Operations & Maintenance Management of probable restoration time of the outage, if it is a mechanical failure.

Electrical Section

- Dispatch one electrician to each pump station in the affected tower. Electrical Contract Supervisor and PA Maintenance Supervisor(s) should respond to the lowest pump station affected.
- The electrician restarts the pumps in the "manual" mode, maintaining a minimum of 20 psi pressure and a maximum of 50 psi pressure.
- Once the Mechanical Section has determined the normal flow rates have

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

5-2.4 LIFE SAFETY and SECURITY

- Operations Control Center will receive reports of possible cooling system failures and thereafter initiate appropriate staff notification via paging system.
- Request the Mechanical Contractor Supervisor to determine whether a cooling system failure has actually occurred.
- In case of a verified cooling system failure, make all notifications listed in Exhibit 4A.
- Notify New York City Fire Department, if necessary
- Post security officers, if necessary.

Operations and Maintenance Management 6-5.3
Property Management 6-5.4

USE OF ELEVATORS DURING EMERGENCIES 6-6

Life Safety & Security - Operations Control Center 6-6.1

EXHIBITS

Diagram of Elevator Locations and Floors Served (1 WTC)
Diagram of Elevator Locations and Floors Served (2 WTC)
Diagram of Elevator Locations and Floors Served (4 WTC)
Diagram of Elevator Locations and Floors Served (5 WTC)

ELEVATOR EMERGENCIES

6-1 GENERAL INFORMATION

6-1.1 SCOPE

This procedure covers elevator emergencies caused by:

- Passenger Entrapments ("Code 1's" or "Slow Speed Runs")
- Service Interruptions (Code 2's)
- Fireproofing Fallout (Code 3's)
- Tower Sway Emergencies - Phase I & II
- Use of Elevators During Emergencies

6-1.2 MAJOR RESPONSIBILITIES

Vertical Transportation

- Upon receipt of a passenger entrapment or other elevator condition, respond, rectify condition and restore the elevator to service as quickly as possible.

Operations and Maintenance Management

- Electrical Section: Assist in securing and/or restoring power to stalled elevator(s) when requested.
- Operations Management Section: Perform listed duties and assist as requested or required.

Police

- With input from elevator contractor, determine the need for evacuation.
- Perform removal of passengers from a stalled elevator.

Life Safety and Security

- Maintain communications with elevator passengers.
- Transmit appropriate notifications.
- Provide security officers for crowd control or other services.
- Secure areas as requested.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues impacting tenants.
- Disseminate information to tenants.

6-1.3 NOTIFICATIONS

Initial report of an elevator emergency will be made to the Operations Control Center Supervisor, identifying the affected elevator or elevator zone and associated conditions.

All notifications thereafter are to be made by the Operations Control Center Supervisor as indicated in Exhibit 6A.

EXHIBIT 6A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM OCC FOR:	TO ALL LISTED BELOW
CODE 1 Passenger Entrapment	Elevator Maintenance Contractor O&MM Supervisor Life Safety & Security Supervisor Police Desk Vertical Transportation Electrical Contract Supervisor
CODE 2 Service Interruptions (See EXHIBIT 6B)	Elevator Maintenance Contractor Vertical Transportation Appropriate Property Manager Appropriate Senior Property Manager Appropriate General Property Manager Manager, Operations & Maintenance Mgmt. O&MM Supervisor Life Safety & Security Supervisor
CODE 3 Fireproofing Fallout	Manager, Operations & Maintenance Mgmt. Vertical Transportation Elevator Maintenance Contractor Environmental Coordinator Asbestos Management Division Life Safety & Security Supervisor O&MM Supervisor Appropriate Property Manager Appropriate Senior Property Manager Appropriate General Property Manager

Exhibit 6A Continued...

FROM OCC FOR:	TO ALL LISTED BELOW
Phase 1 Sway	Manager, Operations & Maintenance Mgmt. Vertical Transportation Elevator Maintenance Contractor Life Safety & Security Supervisor O&MM Supervisor Appropriate Property Manager Appropriate Senior Property Manager Appropriate General Property Manager Manager, Windows on the World (Operating Hours) Manager, Top of the World (Operating Hours)
Phase 2 Sway	Manager, Operations & Maintenance Mgmt. Vertical Transportation Elevator Maintenance Contractor Life Safety & Security Supervisor O&MM Supervisor Appropriate Property Manager Appropriate Senior Property Manager Appropriate General Property Manager Manager, Windows on the World (Operating Hours) Manager, Top of the World (Operating Hours)

FROM	TO
Property Management	All affected tenants

6-2 PASSENGER ENTRAPMENT (Code 1 or Slow Speed Run)

6-2.1 LIFE SAFETY and SECURITY

Operations Control Center Supervisor

- Upon receipt of an emergency call, or notification of an emergency call, obtain the following information from the trapped passenger(s) and confirm elevator information from the appropriate elevator starter:

  - Is elevator moving slowly (slow speed run) or at a complete stop (code 1)?
  - If stopped, what floor?
  - If stopped, how many people aboard elevator?
  - Are trapped passengers comfortable?
  - Is the cab interior illuminated?
  - Is the ventilation fan operating?

- Contact elevator maintenance contractor via radio advising of either a slow speed run or a Code 1.
- Verify elevator maintenance contractor response.
- Notify appropriate Life Safety & Security and O&MM supervisors.
- If the Maintenance Contractor is not on site, make appropriate telephone notifications.
- If the car is determined to be on a slow speed run, advise the passengers of the following:

"Due to a temporary problem, the safety features of your elevator are causing it to move at slow speed. Your elevator is perfectly safe and is continuing on its way to its destination. If anyone should need assistance, please use the emergency call button to contact us. We apologize for this inconvenience, and we thank you for your patience and cooperation. Once again, your elevator is perfectly safe and is on its way to its destination".

- If the car is determined to be a Code 1, advise the passengers of the following:

"We have experienced a problem which has caused your elevator to temporarily stop. Your elevator is perfectly safe. We are in contact with the elevator mechanics that are responding. If anyone should need assistance, please use the emergency call button to contact us. We apologize for the inconvenience and we thank you for your patience and cooperation. Once again, your elevator is perfectly safe and should be moving again shortly."

- Transmit a Code 1 page, stating the affected elevator and other appropriate information. Confirm with supervisors from Life Safety & Security, Vertical Transportation, OM&M and Police that they are responding to the scene.
- Update pass[illegible]

- If stalled elevator cannot be moved in a reasonable time (customarily two hours), notify the Police accordingly. If the Police call for an evacuation, advise the trapped passengers of the following:

"Due to the safety features of your elevator, it cannot be moved. Therefore, Port Authority Safety Personnel will be bringing another elevator alongside yours. At that time, you will receive further instructions. If anyone should need assistance, please use the emergency call button to contact us. Your patience and cooperation is appreciated. Once again, your elevator is perfectly safe, and Safety Personnel are on their way."

- Direct appropriate elevator starter to have the rescue car (elevator adjacent to stalled one) at the designated location for the Police.
- Assist as necessary.
- Complete Code 1 Elevator Outage Report and files.

6-2.2 POLICE

Generally, elevator passenger evacuations are conducted by the Police with the assistance of the elevator maintenance contractor, if available. If elevator maintenance contract staff are not available, the Police may request the Electrical Section to assist by securing power to stalled elevator.

Passenger evacuations should only be called for if elevator service cannot be restored in a reasonable amount of time (customarily two hours) or if extenuating circumstances, i.e. medical emergencies deem it necessary.

Police Supervisor

- Determine the need for evacuation.
- Request that the "elevator evacuation cart" be transported from the B1 emergency room to the chase car.
- Direct two officers and one elevator contractor mechanic (if available) to perform the rescue in the elevator adjacent to the stalled car.
- Ensure that the "main line disconnect switch" of the stalled elevator is off and locked out/tagged out during the rescue.

Note: Responding personnel should be cautioned that elevator machine rooms contain high voltage equipment.

Rescue Car

- Place evacuation equipment aboard chase elevator.
- Don rescue harness and other appropriate safety items.
- Open side panel by unlocking the lock located at floor level.
- Open the operator's panel in the elevator and place the car in "Independent and Inspection" mode.

- Hold side door interlock switch closed using the pole provided on rescue cart.
- Move the car up or down using the appropriate buttons until the chase car is

- Verify that hoist ropes of the stalled car are taut and not slack. If slack, do not perform rescue - wait for elevator contractor.
- Request the main line disconnect switch for the rescue car be secured at the

- Upon occurrence of a Code 2 (Critical elevator or critical service interruption), transmit an "all-page" and identify the affected elevator or service interruption (Refer to Exhibit 6B for the critical elevators or service interruption information).
- Immediately notify the elevator maintenance contractor and Vertical Transportation unit.

6-3.2 OPERATIONS and MAINTENANCE MANAGEMENT

- Arrange for alternate means of transportation and advise the Vertical Transportation unit of the probable effect the interruption(s) will have on tenants.
- insure immediate elevator maintenance contractor response and restoration.
- Advise the Manager, Operations and Maintenance Management, the Manager, Life Safety and Security and the General Property Manager of probable restoration time.

6-3.3 VERTICAL TRANSPORTATION

- Notify elevator maintenance contractor of Code 2 conditions. Monitor response and anticipated duration of interruption.

Elevator Maintenance Contractor

- Immediately respond and expedite repairs, working continuously, 24 hours/day, to restore service.

6-3.4 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General

Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.

- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 6B
CRITICAL ELEVATORS AND CRITICAL SERVICE INTERRUPTIONS

Critical Elevators

1 World Trade Center - 5, 6, 7, 17, 48, 49, 50 and 99
2 World Trade Center - 5, 6, 7, 17, 48, 49, 50 and 99

Critical Service Interruptions - 1 World Trade Center

Elevators

- Removal of three or more elevators in any six car group
- Removal of one or more elevators serving the subgrades
- Removal of one or more Zone III, D Bank elevators when either 6A or 7A shuttle elevators are out of service
- Removal of any of the following shuttle elevators at any time - 50A, 6A, 7A, 17A
- Removal of any of the following freights elevators at any time - 48A, 49A, 50A, 99A.
- Removal of two or more low rise shuttle elevators - 1A to 4A, 8A to 11A
- Removal of two or more high rise shuttle elevators- 12A to 16A, 18A to 23A

Critical Service Interruptions - 2 World Trade Center

- Removal of three or more elevators in any six car group
- Removal of one or more elevators serving the subgrades
- Removal of one or more Zone III, D Bank elevators, A93 to A98, when either 6B or 7B shuttle elevators are out of service.
- Removal of any of the following shuttle elevators at any time - 5B, 6B, 7B, 17B.
- Removal of any of the following freight elevators at any time - 48B, 49B, 50B, 99B.
- Removal of two or more low rise shuttle elevators - 1B to 4B, 8B to 11B.
- Removal of two or more high rise shuttle elevators - 12B to 16B, 18B to 23B.

- Removal of two or more elevators in a three or six car group.
- Removal of any two escalators from E 3 to E 10, or E 11 to E 13.

Critical Service Interruptions – Morgan Stanley/Dean Witter

- One or more elevators in low zone shuttle elevator bank in 2 WTC, (1-4, 8-11)
- One or more elevators in A Bank, B Bank, C Bank or D Bank in Zone 2 in 2 WTC.
- One or more elevators in A Bank or B Bank in 5 WTC.
- One or more elevators in B Bank, Zone 1 in 1 WTC.
- Freight elevator FE 10 or FE 11 in 5 WTC.
- One or more escalators E3 through E10 in 5 WTC.

6-4 FIREPROOFING FALLOUT (Code 3)

6-4.1 LIFE SAFETY and SECURITY

Operations Control Center

- Upon occurrence of a Code 3, transmit an "all-page" and identify the affected elevator(s)
- Immediately notify the Vertical Transportation unit and elevator maintenance contractor.
- Review asbestos data survey to determine if shaftway is "negative" or "positive" (If positive, refer to ACM chapter).

6-4.2 VERTICAL TRANSPORTATION

Elevator Maintenance Contractor

Immediately respond and expedite repairs, working continuously 24 hours/day to restore service.

6-4.3 OPERATIONS and MAINTENANCE MANAGEMENT

- Monitor activities - keep all appropriate WTC units advised.

6-4.4 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.

- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Offi[redacted]

- When Phase 1 conditions are terminated, notify all units to resume normal operations.
- Notify the Windows on the World Manager and the Top of the World Supervisor that Elevators 6 and 7 are operating at slow speed and service man be terminated if winds intensify.

Phase 2

- . Make notifications as per Exhibit 6A.
- Obtain and record from National Weather Service the forecasted wind speeds.
- Record all Phase 2 notifications, activities, and problems in the Elevator Malfunction Outage Report and Operations Control Center log book.
- Closely monitor the Stentofon panel and report any elevators which have a call registered. This may indicate a broken traveling cable and/or potential passenger entrapment.
- Request the elevator maintenance contractor duty mechanic to monitor cable sway in the high-rise elevator pits.
- Transmit a page advising all units of the Phase 2. Update as necessary.
- Notify the elevator maintenance contractor office at 7:30 AM on business days of a recorded Phase 2 during the previous midnight tour.
- Notify the operators of freight elevators 50 A&B, 48 A&B and 5 A&B that they must stop every 10 floors to dampen rope sway.
- Advise the need for "out of service" signs for any freight elevator taken out of service.
- Notify the Windows on the World Restaurant Manager and the Observation Deck Supervisor if Elevators 6 and 7 will be taken out of service.
- When appropriate, notify the elevator maintenance contractor and both of the 107th floor managers that the Phase 2 has ended, indicating also if a Phase 1 remains in effect or completely normal operations have resumed.

6-5.2 VERTICAL TRANSPORTATION

Elevator Starter (Towers One & Two)

Phase 1

- When directed, position speed control toggle switches to "slow speed" for elevators 12-16 and 18-23. Notify Operations Control Center Supervisor when switches are positioned to slow speed.
- When directed, reposition switch to "normal speed".
- Monitor starter's console for stalled elevators and wind speed indications.

Phase 2

Lobby Starter (Towers One & Two)

- When directed, position toggle switch to "slow speed", or when directed, key elevators to "off" position, following standard procedures for removing high rise passenger elevators from service.
- When directed, places elevator 16, 18 or 19 A&B on interzone service (44th to 78th Floor Skylobbies only).

Skylobby Starters (Tower One & Two)

- Secure center cars in Banks C & D of Zones 2 & 3.

Elevator Maintenance Contractor

Phase 1

- Verify high-rise elevators are operating at slow speed. Report any malfunctions to the Operations Control Center Supervisor and elevator maintenance contractor management.
- Monitor conditions in the critical elevator pits and recommend the shutdown of some or all of the high-rise shuttle elevators and local cars based on conditions. Report any malfunctions to the Operations Control Center Supervisor and elevator maintenance contractor management.
- Request the Operations Control Center Supervisor call elevator maintenance contractor if additional mechanics are required.
- Resume normal operations upon notification from Operations Control Center Supervisor.

Phase 2

- Verify that high-rise elevators are operating at slow speed (all high rise passenger elevators are equipped with rope dampeners).
- Monitor conditions in the critical elevator pits and recommend the shutdown of some or all of the high-rise shuttle elevators and local cars as necessary. Report any malfunctions to the Operations Control Center Supervisor and elevator maintenance contractor management.
- Request the Operations Control Center Supervisor call elevator maintenance contractor if additional mechanics are required.
- Resume normal operations upon notification from Operations Control Center Supervisor.

Note: Normally, Elevator Maintenance Contractor staff are not present between midnight and 7:00AM. Upon notification by the Operations Control Center Supervisor, elevator maintenance contractor staff shall respond and perform all required duties.

Contract Supervisor

Phase 1

Establish communications with elevator maintenance contractor and the Operations Control Center Supervisor to verify that:

- Elevator Maintenance Contractor is monitoring critical elevator pits.
- Existing elevator outages are identified, and repair procedures are in place.
- Technical assistance to appropriate WTC staff is ongoing.
- Accelerometer readings are monitored on a "real time" basis.
- Appropriate WTC staff are informed and advised of changing conditions.

Phase 2

Establish communications with Elevator Maintenance Contractor and the Operations Control Center Supervisor to verify that:

- High-rise shuttle elevators are running on slow speed.
- Appropriate local elevators are shutdown.
- Freight elevators 50 A/B are secured on the B1 level. If elevators 5 A/B or 48 A/B are operated for emergency reasons, they must stop every 10 floors. Elevators 17 A/B, 49 A/B, 6A/B and 7 A/B are equipped with rope dampeners.
- Cars 18 or 19 A&B are on interzone mode as required.
- Elevator maintenance contractor is monitoring critical elevator pits.
- Existing elevator outages are identified, and repairs initiated.
- Accelerometer readings are monitored on a "real time" basis.
- Keep appropriate WTC staff informed of changing conditions.

Note: ***Based on expected passenger traffic, the severity of wind and existing elevator outages, during non-business hours, the Vertical Transportation Manager or Contract Supervision staff will determine if their presence is required at the World Trade Center to assist with the emergency.***

6-5.3 Operations and Maintenance Management

Duty Operations Management Supervisor

Phase 1

- Notify Life Safety and Security Supervisor of the emergency and request the posting of two security officers at each of the main lobby elevator control panels.
- Direct Elevator Starters to position toggle switches to "slow speed" at the appropriate starters control panels.
- Monitor Starters panel and investigate stalled elevators.

- Based on weather forecast, determine if it is necessary to activate a Phase 2 alert, in advance of the high winds.
- Determine when to resume normal operations (request the Operations Control Center to make appropriate notifications).
- Request Life Safety and Security Supervisor to advise security officers to monitor all shuttle elevators and to report any out of service cars.

Phase 2

- Notify Life Safety and Security Supervisor of the emergency and request the posting of security officers as needed.
- Direct Elevator Starters to monitor all shuttle elevators and to report any out-of-service cars.
- Verify that elevator operators on Cars 5 A&B, 48 A&B and 50 A&B are stopping the cars every ten floors.
- Notify the Elevator Starters to immediately slow down or, if necessary, shut down, all high-rise shuttle elevators and/or high rise freight elevators based on weather information and recommendations from the elevator maintenance contractor.
- Notify the Elevator Starter to place elevators 16, 18 or 19 A/B on interzone, or full service, as required.
- Direct skylobby Starters to shut down the center cars in banks C & D of Zone 2 & 3 in both Towers.
- Monitor Starters console and investigate stalled elevators.
- Post signs in skylobbies to direct tenants and patrons to proper access or exit routes.
- Determine when to resume normal operations or downgrade to Phase 1 and request the Operations Control Center Supervisor to make appropriate notifications.
- During business hours, may obtain verbal approval of the Manager, Vertical Transportation to waive specified procedures.

6-5.4 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.

CHAPTER 7

FIRE EMERGENCIES

CHAPTER 7

FIRE EMERGENCIES

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FIRE EMERGENCIES

7-1 GENERAL INFORMATION

7-1.1 SCOPE

This procedure covers the response to fire or smoke conditions and is divided into two sections:

- World Trade Center emergency response
- PATH emergency response (incidents occurring in the PATH area only)

7-1.2 MAJOR RESPONSIBILITIES

7-2.1 Life Safety and Security

Fire Safety Director

Under certain circumstances, duties may be delegated to Life Safety & Security Supervisor during business hours. During "off-hours", LS&S Supervisor will assume role.

- Respond to the appropriate Fire Command Station, or scene, and assume the

[redacted]

- Direct overall activities as related to emergency.

[redacted]

- Traditional Fire/Rescue Role - Respond to scene, investigate alarm, extinguish fire, perform rescue/EMS functions and other associated duties.

7-2.4 Operations and Maintenance Management

Operations Management Section

- Assist with evacuation if requested.
- Provide other assistance as requested

Mechanical Section

- When requested, operate fire pumps and activate smoke purge.
- Secure sprinkler water shutoff valves at the request of the Fire Safety Director or New York City Fire Department Chief Officer.
- Provide other assistance as requested.

Electrical Section

- When fire incident is secured, reset smoke detectors or alarm panels at the request of the Fire Safety Director or Fire Command Station.
- Respond to electrical incidents.
- Remotely secure equipment upon request.
- Provide other assistance as requested.

7-2.5 Property Management

- Act as WTC Liaison Officer.
- Coordinate with Life Safety & Security on issues directly impacting tenants.
- Disseminate information to tenants as appropriate.

7-2.6 Tenant Fire Safety Team

- Report fire or smoke conditions.
- Perform an organized evacuation at the sound of the appropriate alarm or when instructed to do so by World Trade Center Emergency Personnel.

7-1.3 NOTIFICATIONS

The initial report of a fire or smoke condition is generally received in one of three ways:

1. A smoke detector or sprinkler is activated, automatically transmitting an alarm to the appropriate Fire Command Station.
2. A manual "pull station" device is activated by an occupant.

3. A telephone call reporting a condition is made to the Police Desk and/or the

EXHIBIT 7A
NOTIFICATIONS

NOTE: In order to avoid unnecessary concern to tenants/occupants, all radio transmissions should refer to a fire alarm or fire emergency as a "Possible 8-8" or "Actual 8-8" as appropriate.

Refer to Appendix A for names and telephone numbers.

For all serious incidents, actual fires, etc., individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	PRIORITY	TO
Police	1st (Radio)	General radio alert to all units
	2nd	Fire Safety Director Security & Life Safety Director Life Safety & Security Supervisor Police Supervisor Central Police Desk
OCC	1st	General radio alert to all units Fire Safety Director (LS&S Supervisor during off-hours)
	2nd	*Verify Fire Safety Director & LS&S Supervisor have received notification* All individuals listed in "Fire Emergency" paging group
	3rd	PA Maintenance Supervisor (Mechanical) PA Maintenance Supervisor (Electrical) Manager, Operations and Maintenance Management Supervising Engineer

7-2 WORLD TRADE CENTER FIRE EMERGENCY RESPONSE

There is no Port Authority responsibility for fires or fire alarms at the Mariott Hotel (3 WTC), US Customs House (6 WTC) and Seven World Trade Center. However, World Trade Center emergency personnel may respond to assist with evacuation, crowd control, etc. Fire alarms from the above locations are transmitted directly to individual proprietary central stations, which notify the New York City Fire Department. The Fire Department responds directly to the Fire Command Station in the above buildings.

At no time are unauthorized individuals to respond to a fire scene without the approval of the WTC Fire Safety Director (or designated representative) or the Fire Department Chief Officer on the scene.

7-2.1 LIFE SAFETY AND SECURITY

Fire Safety Director

- Respond to the Fire Command Station, or scene, as appropriate, and assume all duties and responsibilities of the Fire Safety Director.
- Verify that the New York City Fire Department has been notified of the alarm.
- Insure that the World Trade Center Fire Brigade/Emergency Response Team are notified and respond.
- Direct overall activities and response.
- Coordinate all activities with New York City Fire Department and other Emergency Response Personnel.
- If necessary, confer with Police supervisors and the Floor Warden of the affected floor(s) to determine conditions on the floor(s) and identify, if necessary, areas to be evacuated, route of evacuation, stairwells available and potential refuge floors.
- Initiate evacuation procedures.
- Determine if the general public should be restricted from the affected area(s) and if so, utilize appropriate security staff to restrict access.
- If emergency occurs while the Visitors Desks are in operation, notify staff to discontinue issuing visitors passes to the affected area(s).
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.
- When emergency is secured, ensure that all alarm and public address systems are reset.
- Prepare Port Authority Fire Report (Form 1624).
- Prepare appropriate memorandums/reports.
- Investigate cause and origin of fire.
- In the event of an actual fire, prepare a chronological report noting the all pertinent details.

In a fire of a suspicious nature, the FDNY Chief Officer may order a formal investigation to determine the origin and cause of the fire. Such activities are under the jurisdiction of the New York City Fire Department Bureau of Fire Investigation (Fire Marshals). Upon their arrival at the facility, the WTC Fire Safety Director shall be immediately notified.

Operations Control Center Supervisor

- If an alarm, telephone call or notification by any other means is received at the Operations Control Center, the Operations Control Center Supervisor will immediately notify the appropriate Fire Command Station, the Fire Safety Director (Life Safety & Security Supervisor off-hours) and the police desk.
- The Police Desk and OCC will transmit a general broadcast of all information on all WTC radio frequencies.
- An alpha-numeric message noting all pertinent details will be transmitted via the OCC Page Net system to all members of the Fire Emergency chapter.
- If a fire, smoke or other unusual condition is confirmed, a secondary Alpha-Numeric page will be transmitted, with periodic updates as directed.
- The OCC Supervisor will monitor all facility radio frequencies and insure that "radio silence" is maintained by individuals not directly involved with the emergency.
- Arrange for emergency elevator service as requested.
- Continue to transmit information and/or messages as needed to units responding to the emergency (Fire/Life Safety, Security, Fire Command Stations, Electrical Base, Mechanical Base, Elevator Contractor Base, etc.)
- Notify the Windows on the World and Top of the World Observation Deck Managers/Supervisors, as appropriate, so they are aware of the facility emergency. This is necessary in order to reduce anxiety to tenants, visitors, guests, etc. when numerous emergency vehicles respond to the building entrances.

Security Officers

Vertical Patrols

- Upon notification of a fire emergency, the Vertical Patrol Security Officers will report to the Fire Command Station in the main lobby and then will visit

- Officers will respond to at least one floor below the fire floor with a fire response cart from that particular zone and:
- Rendezvous with the supervisor at a designated location.
- Don appropriate personal protective equipment including Self Contained Breathing Apparatus.
- Proceed up stairwell to the fire floor.
- At the direction of the supervisor, officers may be directed to attempt to control, and if possible, extinguish incipient stage fires.
- Perform cursory search for victims using 150 foot safety line.

Subgrade Post

Officers respond to a fire in the subgrade area with a fire response cart from the B1 Emergency Equipment Room. If the fire alarm is not in the Subgrade, Post 9 responds to the Police Desk to "stand by" with the Subgrade Fire Cart to respond to the fire scene at the request of the supervisor.

7-2.3 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

In the event of an actual emergency:

- Establish communications with the Fire Safety Director, Fire Safety Coordinator or Life Safety and Security Supervisor.
- Respond to the appropriate Fire Command Station.
- Assist as required or requested.

Operations Group Supervisor

In the event of an actual emergency:

- Respond to at least one floor below the affected floor and await further instructions.
- Upon notification to proceed to the affected floor, respond via stairway and establish communications with the Fire Command Station using the Floor Warden telephone.
- Should an evacuation become necessary, assist with control of the evacuees and assist in removing them from the floor.
- Once evacuation is completed, leave the floor to assist with control of the evacuees on the safe refuge floor. Report all activities and information to the Fire Command Station.

STAFF NOT TRAINED IN THE USE OF SELF CONTAINED BREATHING APPARATUS AND ASSOCIATED SAFETY PROCEDURES SHOULD NOT ATTEMPT TO USE SUCH EQUIPMENT AS IMPROPER USE OF BREATHING APPARATUS IN CONTAMINATED ATMOSPHERES COULD RESULT IN SERIOUS INJURY OR DEATH

Mechanical Section

Supervisor, Mechanical Contractor

- Upon receipt of a fire alarm notification, dispatch staff to operate the fire pumps in the affected building and thereafter "stand by" for additional instructions.
- For alarm conditions in the PATH terminal, a mechanic must be dispatched to operate selected fans at the PATH Motor Control Center.
- As directed by the Fire Safety Director or Fire Department Chief Officer, direct personnel to activate the smoke purge fans.
- As directed by the Fire Safety Director or Fire Department Chief Officer, direct personnel to secure sprinkler water shutoff valves.

Port Authority Supervisor

- Upon notification of an actual fire emergency, or at the request of the Fire Safety Director, respond to the Fire Command Station in the lobby of the affected building to assist as necessary.
- In response to a Sprinkler Flow Alarm, ensure that one staff member is dispatched to one floor below the affected floor on all sprinkler alarms. This individual will "stand by" and when advised by the appropriate Fire Safety staff that the emergency is secured, will stop the flow of water from the activated heads by securing the valves subdividing the area.
- Ensure that contract personnel operate appropriate fire pumps and activate smoke purge fans as necessary.

Electrical Section

Supervisor, Electrical Contractor

- Upon receipt of a fire alarm notification, dispatch a staff member to respond to at least one floor below the affected floor to "stand by". This individual may be called upon to lend assistance should the emergency involve electrical closets or fixtures. For emergencies in subgrade areas, a staff electrician will be dispatched to the Fire Command Station in the building nearest the affected area.
- Upon notification of an actual fire emergency, dispatch one contract electrician to at least one floor below the affected floor, two electricians to the nearest sub-station below the affected floor and a supervisor to the Fire Command Station of the affected building to assist, if necessary. For emergencies in subgrade areas, a supervisor and five electricians will respond to the Fire Command Station in the building nearest the affected area.
- Ensure that smoke detectors and/or alarm panels are reset and cleared once the situation is established as a non-emergency or when the emergency is secured.
- Respond to electrical incidents and secure equipment (remotely) at the request of the Fire Safety Director or Fire Department Chief Officer.
- In the event of a major disaster (fire, explosion, power failure, etc.), all staff electricians (excluding the response team) will respond to the electrical shop/office. If the building in which the shop is located is the scene of the emergency, all electricians will respond to:

  - The corner of Church Street and Liberty Street.
  - If inaccessible, the corner of Church Street and Fulton Street, near 5 WTC.

- During an actual fire emergency, insure the use of appropriate radio call signs to properly identify electrical personnel responding to the emergency.
- Provide portable emergency power where needed or as requested.

Port Authority Supervisor

- Upon notification of an actual fire emergency, or at the request of the Fire Safety Director, respond to the Fire Command Station in the lobby of affected building to assist as necessary.
- In response to fire emergencies threatening normal electrical service, ensure that electrical contract staff are dispatched and are "standing by" to secure power as requested.

AT NO TIME ARE STAFF TO PROCEED DIRECTLY TO THE SCENE OF A FIRE EMERGENCY WITHOUT THE APPROVAL OF THE FIRE SAFETY DIRECTOR (OR DESIGNATED REPRESENTATIVE) OR THE ON-SCENE FIRE DEPARTMENT CHIEF OFFICER

7-2.4 NEW YORK CITY FIRE DEPARTMENT

- Respond to the scene of possible/actual fire emergencies.
- Command incident.
- Control/extinguish fire.
- Evacuate occupants, if necessary.
- Determine need for smoke purge.
- Advise when fire incident can be "secured".

7-2.5 VERTICAL TRANSPORTATION

Supervisor, Elevator Maintenance Contract

- Upon notification of an actual fire emergency, or at the request of the Fire

- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

Tenant Assistants

- Report to the Situation Room to assist Property Managers in the handling of tenant inquiries.

7-2.7 TENANT FIRE SAFETY TEAM

Under New York City Code, each floor of a high rise building must be under the direction of a designated Floor Warden who will coordinate the initial evacuation of occupants in the event of fire. The Floor Warden is assisted by Deputy Floor Wardens and Searchers. Tenant Fire Safety Teams are instructed to immediately report any fire or smoke condition by telephoning the Police Desk or by activating one of the manual pull stations on their floor.

The main duties of the Floor Warden are:

- Insure that an alarm has been transmitted.
- Insure that all occupants are notified of the fire and that they proceed immediately to execute the Fire Safety Plan.

In the event of fire, ascertain location of the fire and coordinate the evacuation of the floor in accordance with directions received and the following guidelines:

- The most critical evacuations must occur on the fire floor and the floor directly above.
- Evacuation from the other floors shall be instituted when instructions from the Fire Command Station or conditions indicate such action.
- Evacuation should be via uncontaminated stairs being sure to avoid stairs being used by the Fire Department personnel. If this is not possible, Fire Department personnel should be made aware before a door to the fire floor is opened.
- Evacuation to two or more levels below the fire floor is generally adequate.
- In the event that the stairways serving the floor and/or floors above are unusable due to contamination or cut off by fire and/or smoke, or that several floors above involving large numbers of occupants must be evacuated, consideration may be given to using elevators in accordance with the following:

- If the elevator servicing a floor also services the fire floor, it shall not be used. However, elevators may be used if the Floor Warden receives specific instructions from the Fire Safety Director or Fire Department.
- If elevators do not service the fire floor and their shafts have no openings on the fire floor, they may be used at the direction of the Fire Safety Director or Fire Department.
- Elevators operated by Firefighters or trained building personnel may be used.
- The Floor Warden shall select the safest stairway to use for evacuation on the basis of the location of the fire and any information received from the Fire Command Station. The Floor Warden shall check the environment in the stair prior to entry for evacuation. If it is affected by smoke, an alternate stair shall be selected and the Fire Command Station notified.
- Ensure that the Fire Command Station is informed of the means being employed for evacuation by the occupants of the floor.
- Floor Wardens on floors above the fire shall, after executing the Fire Safety Plan, notify the Fire Command Station of the means of egress being used for evacuations.
- Inform the Fire Command Station of the location of evacuees.

7-3 FIRE RESPONSE FOR PATH EMERGENCIES

(in addition to general fire response procedures)

7-3.1 LIFE SAFETY & SECURITY

Fire Safety Director

- Respond to the appropriate Fire Command Station, or scene, as appropriate, and assume all duties and responsibilities of the Fire Safety Director.
- Verify that the New York City Fire Department has been notified of the alarm.
- Insure that the World Trade Center Fire Brigade and Emergency Response Team are notified and respond.
- Direct overall activities and response.
- Coordinate all activities with New York City Fire Department and other Emergency Response Personnel.
- If necessary, confer with World Trade Center and PATH Police supervisors to determine conditions and identify, if necessary, areas to be evacuated, route of evacuation, stairwells used and potential refuge areas.
- Initiate evacuation procedures.
- Determine if the general public should be restricted from the affected area(s) and if so, utilize appropriate security staff to restrict access.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.
- When emergency is secured, ensure that all alarm and public address systems are reset.
- Prepare Port Authority Fire Report (Form 1624).

- Prepare appropriate memorandums/reports.
- Investigate cause and origin of fire.
- In the event of an actual fire, prepares a chronological report noting the all pertinent details.

Operations Control Center Supervisor

- Upon notification of a PATH fire alarm or report of an actual fire, immediately make all notifications in Exhibit 7A.
- Advise the PATH Train Master of all alarms.

Security Officers

Vertical Patrols

- Upon notification of a PATH fire emergency, contact sector supervisor to determine if assistance is required in PATH area(s).

Sector Supervisors

- Upon notification of a PATH fire emergency, contact Life Safety & Security Supervisor via radio to receive assignment.

Security Officer "Key Run"

- Upon notification of a PATH fire emergency, respond to the Operations Control Center where the appropriate master keys and Fire Department radios will be obtained. Thereafter, the Key Run will contact the Life Safety & Security Supervisor via radio to ascertain where to respond.

Resident Manager - Security Contractor

- During business hours, respond to PATH Square and contact the Life Safety and Security Supervisor via radio.

7-3.2 POLICE

- Respond to all PATH fire alarms at the World Trade Center.

WTC Police Desk Officer

- Notify Fire Safety Director, Supervisor, Mechanical Contractor and Port Authority Chief Maintenance Supervisor (Mechanical).
- Advise PATH Police of the alarm and location if known.

7-3.3 OPERATIONS and MAINTENANCE MANAGEMENT

Mechanical Section

Supervisor, Mechanical Contractor

- Respond to the HVAC Fan Control Room and make contact with the PATH Power Director utilizing the direct telephone line.
- Direct contract personnel to sequence fans in conjunction with guidance from the Train Master.

7-3.4 PATH

Power Director's Office

- Instruct the Supervisor, World Trade Center Mechanical Contractor to activate a specific ventilation pattern based on the fire location indicated on the HVAC system chart. The fire location zone is the area identified by the PATH Train Master based on the notification of a fire and/or smoke condition.

Power Director's Office

- Notify PATH personnel and coordinate system power appropriately as directed by the PATH Train Master.
- Dispatch electrical personnel to reset the fans in Substation #3 upon completion of the incident.

Train Master

- Notify PATH personnel of fire and/or smoke conditions.
- Guide the Supervisor, World Trade Center Mechanical Contractor in sequencing fans.
- Inform the PATH Power Director of the specific fire location based on the fire and/or smoke conditions.
- In the event of a major incident, designate a PATH employee as the on-scene coordinator. This employee will be responsible for establishing a Communications Command Post to coordinate the response and to provide an open channel of communications between the Fire Department, Emergency Medical Services, WTC Police, WTC Fire & Life Safety, WTC Security personnel, PATH Police and the Train Master.
- Advise the Operations Control Center of alternate service strategies, if applicable.

EXHIBIT 7C
EMERGENCY FIRE RESPONSE CARTS

LOCATION	PURPOSE
Towers One & Two	
Lobby Level Emergency Room adjacent to freight elevator 48	For use on fires in Zone 1
44th floor Skylobby Emergency Room - at main corridor intersection	For use on fires in Zone 2
78th floor Skylobby Emergency Room - at main corridor intersection	For use on fires in Zone 3
Two World Trade Center, 110th floor	For use on fires on observation deck
4 WTC	
Lobby level Emergency Room adjacent to freight elevators FE3 - FE4	For use on fires in 4 WTC and Concourse stores
5 WTC	
Lobby Level Emergency Room - Vesey Street lobby	For use on fires in 5 WTC
Subgrade	
Police Emergency Room	For use on Subgrade fires parking garages and truck dock

CHAPTER 8

FLOODS

CHAPTER 8

FLOODS

GENERAL INFORMATION 8-1

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FLOODS

8-1 GENERAL INFORMATION

8-1.1 SCOPE

This procedure covers floods which generally occur due to:

- Mechanical failures in the building and tenant water systems.
- Structural failures within the complex which may allow rain or ground water to penetrate and flood an area.

8-1.2 MAJOR RESPONSIBILITIES

Operations and Maintenance Management

- Operations Management - Insure that initial response by the cleaning contractor is prompt and effective.
- Mechanical Section - Secure mechanical systems.
- Electrical Section - Prevent electrical hazards.
- Structural Section - Repair or replace damaged ceiling tiles, walls, carpeting, etc.

Vertical Transportation

- Insure that elevator maintenance contractor inspects and repairs damaged equipment.

Life Safety and Security

- If necessary, respond to appropriate Fire Command Station to assume the duties of the Fire Safety Director if flood has affected fire/life safety systems.
- Deploy security officers as necessary based on the severity of the situation.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues affecting tenants.
- Notify appropriate tenants/disseminate information.

8-1.3 NOTIFICATIONS

- The initial report of a flood will be made to the Operations Control Center Supervisor identifying the following items:

- In instances where fire protection services are compromised, notify the Fire Safety Director and respond to the appropriate Fire Command Station and assume appropriate duties.
- Coordinate all activities with the New York City Fire Department, if necessary.
- Direct public address announcements, if necessary.
- Deploy security staff to secure evacuated or vacated floors, zones and areas to prevent reoccupancy.
- Dispatch "key-runs" as necessary.

8-2.4 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

- Location
- Size of flood
- Cause (if known)

The Operations Control Center Supervisor will make all notifications listed in Exhibit 8A.

EXHIBIT 8A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TYPE	TO
OCC	**Any Flood**	Manager, Operations & Maintenance Management Supervising Engineer Manager, Operations Management ABM Building Services Office (business hours only) Supervisor, Mechanical Contractor PA Maintenance Supervisors Supervisor, Electrical Contractor All individuals listed in "Flood" paging group
	Large Floods	Vertical Transportation Elevator Maintenance Contractor Life Safety/Security Supervisor Fire Safety Director Security & Life Safety Director Appropriate General Property Manager Appropriate Senior Property Manager Appropriate Property Manager(s) Manager, Operations & Maintenance Management Supervising Engineer PA Maintenance Supervisors Police Desk
O&MM Duty Supervisor	**Any Flood**	Necessary O&MM Supervisors Janitorial Contractor Management

8-2 RESPONSE

8-2.1 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

- Dispatch an Operations Group Supervisor to the area to determine the severity of the situation.
- Request Operations Control Center Supervisor to instruct freight elevator operators to position elevators above the flood floor(s), if necessary. If passenger elevators are affected, direct the elevator starter to reposition them also (if the elevator starter is not available, the Operations Group Supervisor will need to undertake this duty).
- If the flood is on an asbestos containing material (ACM) floor, refer to the Asbestos Contamination chapter for proper procedures.
- If any elevator cabs, shafts or pits show evidence of water, request elevator maintenance contractor to make repairs as soon as possible.
- If *absolutely necessary*, remove tenants or patrons utilizing non-affected local elevators. Otherwise, directs evacuees to use stairways to access an unaffected elevator bank (or use freight elevators).
- Continuously update Operations Control Center.

Operations Group Supervisor

Direct janitorial contractor to immediately:

- Respond with flood cart.
- Secure the affected area.
- Pick up and remove water using wet-vacs, pumps, mops, buckets, etc.
- Cover furniture and other tenant property with polysheeting/plastic.
- Direct elevator starters to move freight and passenger elevators at least one floor above the affected area to prevent water damage.
- Request the Life Safety & Security Supervisor to secure affected area, as needed.
- When flood has been secured, direct janitorial contract staff to begin clean up.
- Arrange for cleaning, shampooing and drying of carpeting.

Mechanical Section

Maintenance Supervisor or Mechanical Contract Supervisor on duty directs staff to:

- Respond immediately to flood location.
- Determine the origin of the leak and system(s) affected.
- Secure valves and quick drain at a suitable location if possible.

- Authorize the 24 hour operation of HVAC systems to speed the "drying out" of affected areas.
- Provide a verbal report to the Duty Supervisor concerning origin of flood and expected duration of any system outage caused by securing of the water leak (i.e. sprinklers, domestic water, etc.).

Electrical Section

Maintenance Supervisor or Electrical Contract Supervisor on duty directs staff to:

- Check electric closets and floor power cells to determine if flood waters have affected systems.
- Divert water and cover circuit breakers with plastic.
- Secure power if electrical shock hazards exist.
- Report to the Duty Supervisor the extent of related electrical outages caused by flood.
- Provide temporary power, if needed, to facilitate cleanup and repair.
- Clean and repairs damaged electrical systems.

Structural Section

Maintenance Supervisor or Structural Contract Supervisor on duty directs staff to:

- Replace damaged ceiling tiles.
- Replace damaged carpets.
- Repair any damage to sheetrock walls.
- Assist with other related activities.

8-2.2 VERTICAL TRANSPORTATION

Direct elevator maintenance contractor to:

- Inspect elevators and escalators for damage and perform any necessary repairs.

8-2.3 LIFE SAFETY AND SECURITY

Life Safety and Security Supervisor

- Upon report of a flood, immediately contact the Operations and Maintenance Management Duty Supervisor.
- Request OCC Supervisor to make all notifications listed in Exhibit 8A.
- Request OCC Supervisor to transmit an Alpha-numeric page.

CHAPTER 9

NATURAL GAS LEAKS

CHAPTER 9

NATURAL GAS LEAKS

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NATURAL GAS LEAKS

9-1 GENERAL INFORMATION

9-1.1 Scope

This procedure covers the response to natural gas leaks occurring within the World Trade Center complex.

9-1.2 MAJOR RESPONSIBILITIES

Life Safety and Security

- Staff respond to appropriate Fire Command Station to assume the responsibilities of Fire Safety Director.
- Coordinate all activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuation, if necessary.
- Direct use of public address announcements.
- Deploy security officers to secure area, deny access to unauthorized individuals and provide other related security functions.
- Dispatch "key runs" as required.

New York City Fire Department

- Respond to incident, vent gas and secure leak if possible.
- Initiate precautionary suppression operations.
- Supply technical assistance as appropriate.
- Recommend when area(s) can be reoccuppied.

Police

- Respond as building Fire Brigade.
- As requested, secure area to prevent unauthorized entry.

Operations and Maintenance Management

- Mechanical Section: Recommend mechanical ventilation and implement same when requested by the Fire Safety Director or Fire Department personnel.
- Electrical Section: Reset gas detection equipment when requested by the Fire Safety Director or Fire Department personnel.

Con Edison

- Respond to incident. Secure leak "upstream" of main gas valve.
- Provide technical assistance.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues directly impacting tenants.
- Disseminate information to tenants.

9-1.3 NOTIFICATIONS

The initial report of a natural gas leak will be made to the Operations Control Center, identifying the location of the leak or odor.

All notifications are to be made by the Operations Control Center Supervisor and are listed in Exhibit 9A.

EXHIBIT 9A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TO
OCC	Fire safety Director Life Safety and Security Supervisor Police Desk Manager, Operations & Maintenance Management PA Maintenance Supervisors Security & Life Safety Director Office of Environmental Policy & Management Appropriate General Property Manager Appropriate Senior Property Manager Appropriate Property Manager All individuals listed in "Gas Leak" paging group

NOTE: If the incident occurs in the Marriott Hotel (3 WTC), the Hotel Chief Engineer shall be contacted immediately.

EXHIBIT 9B
MAIN GAS VALVE LOCATIONS

Marriott Hotel	6" shutoff valve located in closet on B1 level of hotel parking lot adjacent to entrance ramp from Liberty Street, labeled "GAS METER ROOM, SHUTOFF VALVES INSIDE". Serves - Laundry Services - Kitchens in Lobby, - Plaza & 1st floor levels
4 WTC	3" shutoff valve located in B1 level Mechanical Equipment Room between fans ACS #S2-3 and ASOA S2-1E. Serves - Coffee Exchange
5 WTC	6" shutoff valve located on the Concourse at Vesey Street inside closet marked "GAS METER ROOM, SHUTOFF VALVES INSIDE". Serves - Sbarro's - Menchaiko Tei - Fine & Shapiro

9-2 RESPONSE

9-2.1 LIFE SAFETY & SECURITY

Operations Control Center Supervisor

Upon notification of gas detection, make all notifications listed in Exhibit 9A. To reduce the anxiety of visitors at public facilities at the World Trade Center, including Widows on the World and the Top of the World Observation Deck, the Restaurant and Observation Deck Managers/Supervisors must be notified so they are aware of the facility emergency. This is necessary when numerous emergency response vehicles respond to building entrances.

Note: Detection of gas by detectors automatically shuts off gas and activates an alarm at the Fire Command Station for the Sbarro's and Menchaiko-Tei tenant spaces only.

Life Safety and Security Supervisor

- Respond to affected Fire Command Station, or scene of emergency, and assume the responsibilities of the Fire Safety Director.
- Verify notification to Fire Safety Director.
- Coordinate all activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuation procedures, if required.
- Direct public address announcements, if required.
- Determine if the general public should be restricted from the affected area(s). If so, utilized appropriate security staff to restrict access.
- Deploy security staff to secure evacuated areas, floors, zones, etc. and to prevent reoccupancy.
- Dispatch "key-runs".

9-2.2 NEW YORK CITY FIRE DEPARTMENT

- Respond to affected area.
- Clear area of gas and existing fire hazards.
- Secure Main Gas Valve(s).

9-2.3 POLICE

- Respond to scene.
- As requested, secure and evacuate area as necessary.
- Prevent unauthorized entry.

9-2.4 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

- Respond to the affected area to assist Life Safety & Security and Police in securing the area to prevent unauthorized entry

Note: based on the severity of the situation, Self Contained Breathing Apparatus may be required. Staff not trained in the use of SCBA should not attempt to use such equipment as improper use of breathing apparatus in atmospheres dangerous to life and health could result in serious injury or death.

Mechanical Section

- Provide ventilation to the affected area if requested by Life Safety and Security or Fire Department.
- Repair leak once area is deemed safe.
- Verify that no gas is leaking after gas service is restored.

Electrical Section

- At the request of Life Safety and Security or the Fire Department, reset gas detection devices.

9-2.5 CON EDISON

- Secure gas leak(s). Provide technical assistance.

9-2.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.

- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

CHAPTER 10

LABOR DISPUTES AND DEMONSTRATIONS

CHAPTER 10

LABOR DISPUTES AND DEMONSTRATIONS

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Exhibit 10A	Notifications
Exhibit 10B	Emergency Plaza Closing
Exhibit 10C	Emergency Mall Closing

LABOR DISPUTES AND DEMONSTRATIONS

10-1 GENERAL INFORMATION

10-1.1 SCOPE

This procedure covers the response to labor disputes which occur in the form of:

- Work stoppages
- Picket lines
- Sabotage

It also covers demonstrations and civil disorder which may require the full or partial closing of the Mall and Plaza.

NOTE: Demonstrations are not allowed on the Mall. However, "free speech" permits may be obtained by interested parties. The permit allows a select number of persons from the same organization to distribute material in designated areas.

Demonstrations are not allowed on the Plaza. However, lawful demonstrations may be allowed on certain portions of Church Street.

10-1.2 MAJOR RESPONSIBILITIES

Affected Unit

- The WTC unit nearest the affected parties, which has best access to information, determines, with the advice of staff, an approach to resolve or reduce the effect of the labor dispute and/or demonstration.

Life Safety and Security

- Along with Police management staff, meet with labor leaders in advance of activities.
- If necessary, respond to the appropriate Fire Command Station, or scene of disturbance, to assume fire safety responsibilities and coordinate response activities.
- Direct use of public address announcements.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals as appropriate.
- Dispatch "key runs" as appropriate.

Police

EXHIBIT 1OC
EMERGENCY CLOSING OF MALL (except PATH)

Action and Location	Staffing Required
1 WTC: Barricade off revolving doors leading to Concourse	4 Porters to set up barricades 3 guards on Tower side of 1 WTC
2 WTC: Barricade off revolving doors leading to Concourse	4 Porters to set up barricades 3 guards on Tower side of 2 WTC
4 WTC: Secure all doors leading to 4 WTC from Liberty St. Install proper signage stating "concourse closed"	2 guards 2 porters
5 WTC: Secure Concourse with barricades but allow PATH entrance via Vesey St.	4 porters 4 guards
Subways: Close BMT Subways Close 8th Ave. Subway Close IRT Subway Put security gates in place from PATH square to 5 WTC	2 OGS securing doors to subways 6 guards (subways) 2 guards (PATH)

NOTE:
For PATH closing, follow above and also notify PATH to suspend service to WTC. Lock 5 WTC, Vesey St. doors and post at least one guard at doors.

- In conjunction with the Life Safety and Security Division and Property Management, meet with labor leaders in advance to communicate rules and regulations regarding such activities at the World Trade Center.
- Monitor picket lines and demonstrations.
- Insure lawful assemblance.
- Enforce protection of life and property.

Operations and Maintenance Management

- Increase frequency of door hardware inspections and repairs. Rekey cylinders as necessary or as directed.

Director's Office

- Insure all Units coordinate activities, including those with staff departments.

Property Management

- Act as WTC Liaison Officer.
- Notify tenants as appropriate or necessary.

10-1.3 NOTIFICATIONS

The initial report of a strike or picket activity will be made by the appropriate Unit Manager or Police supervisor who will make the notifications as listed in Exhibit 10A, identifying the union or other group involved and the degree of actual or potential disruption.

10-2 RESPONSE

10-2.1 AFFECTED UNIT

- Upon report of a labor dispute or possible demonstration, immediately discuss the situation with appropriate contract management, Police supervision or other entities to understand the nature and extent of the dispute or possible demonstration.
- Make notifications according to Exhibit 10A.
- Meet with the union representative(s) to identify:

1. The form of action: picket line, work stoppage, demonstration, etc.
2. The anticipated time of implementation and its duration.
3. The specific demands of the union or organization.

- Attempt to resolve issues with contract management or union representative(s).
- Prepare a strategy to effectively maintain the unit's daily responsibilities.
- Prepare to secure certain sensitive areas during the labor dispute or demonstration. If necessary:
- Request Life Safety and Security to deactivate magnetic access cards in the possession of the personnel involved in the potential demonstration.
- Request Life Safety and Security to extend or increase security presence in designated areas.
- Request the Police to prepare for possible emergency and provide available intelligence.
- Request the Port Authority Locksmiths to re-key certain doors, areas, etc. as necessary.
- Discuss issues with the Law Department to determine if legal remedies exist.
- Meet with the Director and other key management personnel to finalize the plan of action which will minimize the effect on World Trade Center tenants, patrons and visitors.

10-2.2 DIRECTOR'S OFFICE

- Monitor situation through daily reports from affected units.
- Insure proper actions are taken to minimize the effect on the facility.
- If necessary, personally intercede with union representatives or entities.
- Insure that all units, including the Law Department and Public Affairs, commit sufficient resources to manage the situation.

10-2.3 LIFE SAFETY and SECURITY

- Along with the Police meet with labor leaders in advance of planned activities.

- Depending on the circumstances and activities, and if necessary, respond to the appropriate Fire Command Station, or scene of disturbance to assume fire safety responsibilities.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals at the request of the Police supervisor.
- Direct cancellation of magnetic access cards in possession of personnel involved in potential demonstration.
- Depending on circumstances, restrict issuance of keys or use of "key runs" to sensitive areas, elevators, floors, etc.
- If necessary, authorize issuance of temporary or special identification cards and parking permits.
- Dispatch "key runs" as appropriate.

10-2.4 POLICE

- Obtain information from affected unit or other entities regarding nature and extent of possible demonstration.
- Establish contact with union or demonstration leaders and, along with WTC Management, explain guidelines for proposed activities.
- Contact appropriate PAPD, NYPD and other jurisdiction's intelligence units to obtain pertinent information on past strike or demonstration activities.
- Monitor activities to ensure all rules and regulations are followed and all activities are conducted lawfully.
- Insure all appropriate specialized units are on call or on scene (ESU, Crowd Control Teams, Arrest Teams, etc.).
- Insure that tenant and public access to the facility is unimpeded by picket lines or demonstrations.
- Insure access for mobility restricted individuals.
- Coordinate with Life Safety & Security and Operations & Maintenance Management for additional resources.
- Protect life and property.

10-2.5 OPERATIONS and MAINTENANCE MANAGEMENT

- Arrange for the placement of barricades in designated areas for picketing and/or demonstrations (coordinate with Life Safety & Security).
- With the advice and recommendation of Life Safety and Security, determine the need for re-keying sensitive areas/locations.
- Increase the frequency of inspecting and repairing door hardware.
- Review electronic card access roster to determine if certain cards should be revoked.

10-2.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 10A
NOTIFICATIONS

Refer to the Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TO
Affected Unit	Director's office OCC Police Desk General Property Manager(s) Life Safety & Security Director Fire Safety Director Manager, Operations & Maintenance Management
General Property Manager(s)	Affected tenants
Police	Central Police Desk
OCC	All individuals listed in "Labor Dispute" Paging Group

EXHIBIT 10B
EMERGENCY CLOSING OF PLAZA

Action and Location	Staffing Required
Church St. Plaza entrance: Close ceremonial fence or install barricades	4 porters 2 guards (1 on each ramp)
1 WTC: Secure revolving doors Secure escalators Secure gates (North & South of Tower) Proper signage at the bottom of escalator	1 guard for securing revolving doors & gates 1 porter for signage 1 guard at the bottom of escalator
2 WTC: If observation deck is open, follow procedures for 1 WTC If observation deck is closed: Proper signage at the bottom of escalator explaining plaza, Observation deck, closed;TKTS open Secure gates (east & west of Tower)	1 guard for securing doors and gates 1 porter for signage 1 guard at top of escalator 1 guard at each exit (east & west sides of Tower 2)
4 WTC: Secure revolving doors leading to Plaza	1 guard
5 WTC: Secure revolving doors	1 guard
Full Plaza Closing:	6 guards to insure that no one exits onto plaza except for emergency egress

CHAPTER 11

MEDICAL EMERGENCIES

CHAPTER 11

MEDICAL EMERGENCIES

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Exhibit 11A Information To Be Provided	
Exhibit 11B Notifications	

MEDICAL EMERGENCIES

11-1 GENERAL INFORMATION

11-1.1 SCOPE

This procedure covers the response to medical emergencies occurring in the World Trade Center complex.

11-1.2 MAJOR RESPONSIBILITIES

Police

- Make notifications for Emergency Medical Service response.
- Determine the best arrival location for Emergency Medical Service units.
- Render appropriate assistance to victims.

Life Safety and Security

- Arrange for emergency elevator service via the Operations Control Center elevator communications system.
- In the event of a major event, respond to the appropriate Fire Command Station or scene of incident.
- Coordinate activities with the New York City Fire Department and other emergency response personnel.
- If a need exists to restrict the general public from the area, deploy security personnel as appropriate.

Port Authority Medical Department

- During business hours, respond to medical emergencies for Port Authority employees only.

New York City Fire Department

- When requested, respond to all medical emergencies.

FDNY Bureau of Emergency Medical Services

- When requested, respond to all medical emergencies.

Operations and Maintenance Management

- As requested, direct maintenance contractor to properly clean/disinfect areas where blood or other bodily fluids may be present due to incident.

Property Management

- Act as WTC Liaison Officer.

11-1.3 Notifications

- The initial report of a medical emergency will be made to the Police Desk identifying the information listed in Exhibit 11A.

- Notifications thereafter are to be made by the Police Desk Officer. Additional notifications are made by the Operations Control Center Supervisor in the event of a serious injury or fatality.

11-2 RESPONSE

11-2.1 POLICE

- Upon notification of a medical emergency, the Police Desk Officer will dispatch a Police Officer to the scene.
- The Police Desk will summon Emergency Medical Services.
- The responding officer will advise the Police Desk if additional police or medical personnel are required.
- If the Central Police Desk needs to be advised of any conditions, the WTC Police Desk will make appropriate notifications.
- The Police supervisor will determine if other resources are required (NYPD, multiple ambulances, etc.).
- The Police Desk will coordinate the response to the medical emergency.
- Police Officers on scene will complete appropriate paperwork.
- If deemed necessary by the Police supervisor, a chronological document of events will be established at the Police Desk.
- Until the arrival of Emergency Medical Services personnel, Police Officers will render first aid, comfort and support to victims.

Arrival Locations for Emergency Medical Services

• One World Trade Center	"VIP" Drive
• Two World Trade Center	Liberty Street (inner roadway)
• Three World Trade Center	West Street in front of Marriott Hotel
• Four World Trade Center	Liberty Street (inner roadway).
• Five World Trade Center	Vesey Street entrance
• Six World Trade Center	"VIP" Drive - enter through lobby
• Seven World Trade Center	Vesey Street truck dock
• Plaza	Church Street (inner roadway)
• Concourse	Building closest to call

11-2.2 LIFE SAFETY AND SECURITY

Life Safety and Security Supervisor

- Depending on the circumstances and activities and, if necessary, respond to the appropriate Fire Command Station to assume fire safety responsibilities.
- Coordinate activities with the New York City Fire Department and other emergency response personnel.
- If a need exists to restrict the general public from the area, deploy security personnel as appropriate.
- Dispatch "key runs" as necessary.

Operations Control Center Supervisor

- Make necessary notifications according to Exhibit 11B, where cases of serious injury or fatality caused by accident are involved.
- If the incident involves a Port Authority employee, dispatch a freight elevator to the 62nd floor (Tower One) and direct the operator to stand by to pick up the Port Authority Medical Department response staff.
- In cases of a construction accident, notify the Construction Division.
- Request elevator starters have appropriate elevators on "stand by" for emergency response to the incident.

11-2.3 PORT AUTHORITY MEDICAL DEPARTMENT (business hours only)

Note: The Port Authority Medical Department only responds to medical emergencies involving Port Authority employees.

- Respond to elevator(s) indicated by the Operations Control Center Supervisor for escort to the scene of the incident.
- If necessary, request ambulance service.

11-2.4 FDNY BUREAU OF EMERGENCY MEDICAL SERVICE

- Respond to the designated location as requested.

11-2.5 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations

Control Center and activate all telephones, computers and the Emergency Tenant Notification System.

- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 11A
KEY INFORMATION TO BE PROVIDED FOR MEDICAL EMERGENCIES

Initial notification to World Trade Center Police Desk

- Name
- Title
- Exact location of incident
- Telephone number

Specifics of Incident

- Nature of illness or injury
- Age
- Male/Female
- If subject is conscious or unconscious
- PA Employee
- Previous history of illness or injury
- If area is asbestos contaminated
- Other known hazards

EXHIBIT 11B
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM		TO
Police		FDNY / EMS Appropriate Post Officer Port Authority Medical Dept. (if PA employee - business hours only) For serious injury caused by accident also notify: Police supervisor Life Safety & Security Operations Control Center Public Affairs Risk Management Division
Fatality		All of the above and NYPD
OCC	**For serious Injuries or Fatalities**	Life Safety & Security Supervisor Security & Life Safety Director Fire Safety Director General Property Manager(s) Manager, Operations & Maintenance Management Manager, Construction Division (if due to construction accident) All individuals listed in "Medical Emergencies" paging group

CHAPTER 12

NATURAL DISASTERS

CHAPTER 12

NATURAL DISASTERS

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Vertical Transportation 12-6.4
Construction Division 12-6.5
Property Management 12-6.6

- Deploy staff to emergency generator plant.
- Inspect emergency generators for damaged machines, exhaust systems, cooling lines, distribution panels etc.
- Operate emergency generator plant if necessary.
- Verify that fire alarm/communication systems are operational.
- Remove or shores any light fixtures, signs or other electrical equipment which may be in danger of falling.
- Provide portable emergency power where needed.
- Inspect all electrical systems and initiate repairs.

General Maintenance Section

- Remove debris from evacuation routes as reported by Life Safety and Security or Operations and Maintenance Management.
- Use planks and plywood to make temporary repairs to broken plate glass windows as needed.
- Remove any hanging ceilings, equipment and other materials which may be in danger of falling.
- Inspect and initiate repairs.

Supervising Engineer

- Determine the extent of facility wide damage, directly and through observations/reports from other units.
- Contact Planning Division and/or Quality Assurance Division Structural Engineers for advice.
- Keep managerial staff informed on the extent of damage.

12-6.3 POLICE

- Determine the need to provide medical assistance.
- If necessary, close roadways and re-direct traffic.

12-6.4 VERTICAL TRANSPORTATION

- Direct elevator maintenance contractor to inspect equipment and, if damage is found, initiate repairs.

12-6.5 CONSTRUCTION DIVISION

- Provide assistance in barricading, repair and debris removal as requested.

12-6.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will

NATURAL DISASTERS

12-1 GENERAL INFORMATION

12-1.1 SCOPE

This procedure covers the World Trade Center general response to natural disasters such as high winds, hurricanes, severe rain, winter storms, sub-zero temperatures, tidal surges and earthquakes.

It is subdivided into the following sections:

- General Response
- Thunderstorm / Hurricane / High Wind Response
- Sub-Zero Outdoor Temperature Response
- Tidal Surge Response
- Earthquake Response

12-1.2 MAJOR RESPONSIBILITIES

Life Safety and Security

- Depending on the circumstances and activities, respond to the scene of the incident or the appropriate Fire Command Station.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.
- Make notifications as listed in Exhibit 12A (OCC).
- Arrange for emergency elevator service (OCC).
- Monitor and reports on status of weather to all units (OCC).

Police

- Coordinate activities with the New York City Police Department.
- Make notifications as appropriate.
- Assist in insuring public safety.

Operations and Maintenance Management

- Operations Management: Supervise janitorial contractor.
- Mechanical Section: Secure mechanical systems.

- Provide portable emergency power where needed.

General Maintenance Section

- Upon notification, respond to the affected area.
- If there are broken windows or doors:
- Notify the Police Desk.
- Survey damage and barricade area.
- Secure or "boards up" broken windows/doors if necessary
- Request clean up.
- If there are damaged carpet or ceiling tiles:
- Remove wet ceiling tiles.
- Roll back wet carpet.
- Cut away underpadding.
- Allow up to 24 hours for residual water to stop before reinstallation or replacement.

Supervising Engineer

- Perform a physical facility condition survey to determine problem areas and equipment to be secured.

12-2.4 VERTICAL TRANSPORTATION

- Direct elevator maintenance contractor to secure affected elevators, monitor

- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

12-3 THUNDERSTORM / HURRICANE RESPONSE

A thunderstorm is a storm accompanied by gusty winds, heavy rain, possibly hail, lightning and thunder. A typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Approximately 1,800 thunderstorms are occurring worldwide at any given moment. A thunderstorm is considered severe if it produces hail at lease ¾ inch in diameter and 58 MPH wind speeds. (approximately 10% of thunderstorms that occur each year in the US are classified as severe). Thunderstorms are most likely to occur in the spring and summer months during the afternoon and evening hours.

Every thunderstorm produces lightning and is responsible for an average of 93 fatalities and over 300 injuries annually (chances of being struck by lightning are about 1 in 600,000). Lightning is formed by positive and negative charges produced within the clouds and the discharge of electrical energy between the positively and negatively charged areas. Most lightning occurs within the clouds or between the clouds and the

caused little or no damage as it moved inland, but long after the winds subsided, floods occurred in Pennsylvania and New York that caused 200 fatalities.

- A hurricane ***advisory*** indicates where the storm is located, wind intensity, wind speed and the direction of movement.
- A hurricane ***watch*** is issued for coastal areas when there is a threat of hurricane conditions within 24 to 36 hours.
- A hurricane ***warning*** is used when hurricane conditions are expected in a specified coastal area in 24 hours or less.

12-3.1 LIFE SAFETY AND SECURITY

- Depending on the circumstances and activities, respond to the scene of the incident or the appropriate Fire Command Station to assume Fire Safety responsibilities.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.

[redacted]

emergency.

- Authorize and issues temporary parking permits to emergency response personnel as necessary.

- Assign porters to patrol vulnerable areas as directed.
- Assign Porters to assist mechanical staff to clear all drains on the Plaza, both Towers, subgrade areas and truck dock ramps.
- Check all areas (roofs, Plaza, outside areas, etc.) for loose debris that may become airborne.
- Secure all material from Plaza (chairs, tables, etc.)
- Insure that all vehicles are fueled.

Mechanical Section

- Clear drains on the Plaza, Plaza stairways and ramps.
- Clear West Street drains of dirt, sand, debris, etc.
- Test all sump pumps and make repairs as required.
- Install watertight covers over river water pump motors.
- Test operation of the River Pump Water Station sluice gates.
- Check and clean all roof drains.
- Close all outdoor air dampers in Mechanical Equipment Rooms.
- Follow pump station procedure for high tides.

Electrical Section

- Test subgrade ramp doors.
- "Top off" diesel fuel in emergency generator storage tanks.
- Test emergency generator operations.
- Clear roofs and observation deck of all light duty fixtures.
- Provide portable emergency power where needed.

General Maintenance Section

- Use planks and plywood to make temporary repairs to broken plate glass windows as needed.
- Barricade subgrade ramps with planks, sandbags, etc.

Supervising Engineer

- Perform physical facility condition survey to determine areas of concern and equipment to be secured.

12-3.3 POLICE

WTC Police Desk Officer

- Make all appropriate notifications listed in Exhibit 12A.
- Provide support as requested.

12-3.4 VERTICAL TRANSPORTATION

- Direct elevator maintenance contractor to secure affected elevators, monitor conditions and make any necessary repairs if necessary.

12-3.5 CONSTRUCTION DIVISION

- Provide assistance in barricading and repair as requested by O&MM

EXHIBIT 12B
HURRICANE CATEGORIES

Hurricanes are rated on a scale of one to five, with one being the weakest. Category one, two and three hurricanes are most common in the New York/New Jersey metropolitan area. The Saffir/Simpson Hurricane Scale shown below is used to illustrate a hurricane's damage potential.

Saffir / Simpson Hurricane Scale

Category	Barometric Pressure at Eye (in Inches Mercury)	Wind Speed MPH	*KNOTS*	Damage Potential
1	less then 28.94	74 - 95	*64-82*	minimal
2	28.50-28.91	96 -110	*83-95*	moderate
3	27.91-28.47	111-130	*96-113*	extensive
4	27.17-27.88	131-155	*114-135*	extreme
5	greater then 27.17	greater then 155	*135*	catastrophic

12-4 SUB-ZERO OUTDOOR TEMPERATURES RESPONSE

12-4.1 LIFE SAFETY AND SECURITY

- Depending on the circumstances and activities, respond to the scene of the incident or the appropriate Fire Command Station to assume Fire Safety responsibilities.
- If necessary, coordinate activities with the New York City Fire Department

- ◊ Verify that climax plugs are secured in place in the floor drains located in the fresh air intake plenum in areas 1 and 2.
- ◊ Notify Operations Control Center and Refrigeration Plant of high water conditions.
- ◊ Transmit north and south sluiceways high level alarm and diked area alarm to verify their performance.
- ◊ Place electrical disconnect switches in the off position for the two tubular chlorine pumps.
- ◊ If sodium hypochlorite solution tanks are empty, or near empty, partially fill with fresh water to prevent buoyancy.
- ◊ Provide an emergency water hookup from the hose bib at the water meter to the main flushing piping to the river water pump line.
- ◊ Place electrical disconnect switches in off position for the domestic water bearing lubricants and flush pumps.
- ◊ Prior to the tidal serge, place plastic sheets and sandbags over fresh air intake plenum and the exhaust [illegible]

In the Event of a Power Failure

- Start one or both of the emergency pumps and maintain operations even if the water rises above the operating floor level.
- Recheck the river water level in the sluiceway and throttle the associated sluice gate accordingly to prevent flooding.

Electrical Section

- Secure affected electrical systems.
- Operate Emergency Generator Plant as needed.
- Provide portable emergency power where needed.

General Maintenance Section

- Assist in installing sandbags as requested.

Supervising Engineer

- Based upon most current weather forecast, perform facility survey and identify equipment to be secured. Report findings to Life Safety & Security Division and Director's office.

12-5.4 VERTICAL TRANSPORTATION

- Direct elevator maintenance contractor to secure affected elevators, monitor conditions and make any necessary repairs if necessary.

12-5.5 CONSTRUCTION DIVISION

- Assist in installing sandbags as requested.

12-5.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior

- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

EXHIBIT 12D
100 YEAR FLOOD PENETRATION POINTS

RAMP H TO HOTEL
OPENING 16'
FLOODWATER HEIGHT .85'
SANDBAG TO HEIGHT 1.25'
SANDBAGS REQUIRED - 92

RAMP A (SOUTHBOUND)
OPENING 16.5'
FLOODWATER HEIGHT 1.5'
SANDBAG TO HEIGHT 2.0
SANDBAGS REQUIRED 148

HOTEL PARKING LOTS-WEST ST.
OPENING 30'
FLOODWATER HEIGHT .25'
SANDBAG HEIGHT .50'
SANDBAGS REQUIRED - 86

SOUTH PROJECTION
OPENING 14'
FLOODWATER HEIGHT 1.5'
SANDBAG TO HEIGHT 2.0'
SANDBAGS REQUIRED 124

RAMP C (NORTHBOUND)
OPENING 15.5'
FLOODWATER HEIGHT 1.25'
SANDBAG TO HEIGHT 1.75'
SANDBAGS REQUIRED 120

RAMP B (NORTHBOUND)
OPENING 16'
FLOODWATER HEIGHT 1.85'
SANDBAG TO HEIGHT 2.40'
SANDBAGS REQUIRED 184

6 WTC - VESEY ST. GLASS DOORS
OPENING 24'
FLOODWATER HEIGHT 1.75
SANDBAG TO HEIGHT - 2.25'
SANDBAGS REQUIRED - 240

RAMP D (SOUTHBOUND)
OPENING 16'
FLOODWATER HEIGHT 1.93'
SANDBAG TO HEIGHT 2.50'
SANDBAGS REQUIRED -184

NORTH PROJECTION VENT
OPENING 11'
FLOODWATER HEIGHT 3.25'
SANDBAG TO HEIGHT 1.75'
SANDBAGS REQUIRED 80

NORTH PROJECTION DOOR
OPENING 5'
FLOODWATER HEIGHT 1.25'
SANDBAG TO HEIGHT 1.75'
SANDBAGS REQUIRED 38

6 WTC - WEST ST. GARAGE
OPENING 60'
FLOODWATER HEIGHT 1.05'
SANDBAG TO HEIGHT 1.55'
SANDBAGS REQUIRED 516

6 WTC VESEY ST. - DOOR A
OPENING 3.5'
FLOODWATER HEIGHT 2.45'
SANDBAG TO HEIGHT 3.0
SANDBAGS REQUIRED 38

6 WTC - VESEY ST. GARAGE
OPENING 31'
FLOODWATER HEIGHT 2.45'
SANDBAG TO HEIGHT 3.0'
SANDBAGS REQUIRED 412

12-6 EARTHQUAKE RESPONSE

An earthquake is a wave-like movement of the earth's surface. The earth's crust and upper part of the mantle are constantly pushing and moving along what are known as "fault lines". When rock masses slip along a fault, the energy of an earthquake is released in seismic waves. Earthquakes can be extremely violent, but often they are little more then a minor trembling of the ground.

The damage caused by an earthquake depends on its severity or intensity. The most widely known indicator of severity, the Richter scale, measures the energy released when rock masses suddenly slip. A change of one full point in the Richter scale represents a difference of a factor of approximately 30 in released energy. Therefore, an earthquake of magnitude 7 is roughly 30 times as powerful - in terms of energy released - as a magnitude 6 earthquake.

Earthquake monitoring is conducted by the US Geological Survey, the National Oceanic and Atmospheric Administration and various universities throughout the United States. However, earthquakes can not be precisely predicted and usually occur without warning.

Richter Magnitude	**Effects**
Less than 3.5	Generally not felt, but recorded by seismographs.
3.5 – 5.4	Often felt, but rarely cause damage.
Under 6.0	Slight damage.
6.1 – 6.9	Destructive
7.0 – 7.9	Major earthquake.
8 or greater	Very major earthquake, can cause severe damage.

Comparison of seismic wave energy to TNT

1.0 = 30 pounds	6.0 = 1 million tons
2.0 = 1 ton	7.0 = 32 million tons
3.0 = 29 tons	8.0 = 1 billion tons
4.0 = 1,000 tons	9.0 = 32 billion tons
5.0 = 32,000 tons	10.0 = 1 trillion tons

12-6.1 LIFE SAFETY AND SECURITY

- Depending on the circumstances and activities, respond to the scene of the incident or the appropriate Fire Command Station to assume fire safety responsibilities.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.
- Authorizes use of temporary or special identification cards valid for duration of emergency.
- Authorize and issues temporary parking permits to emergency response personnel as necessary.
- Direct security contractor to have personnel "stand by" as needed.
- Call in additional Life Safety and Security staff as needed.

12-6.2 OPERATIONS and MAINTENANCE MANAGEMENT

- Determine if elevators have stalled and if passengers are trapped and refer to elevator chapter to effect rescue. Caution should be used in using adjacent elevators for rescue since they may also be damaged.
- Secure elevators found to be damaged.
- As a precaution, request Life Safety and Security to close the Liberty Street pedestrian bridge and the 7 World Trade Center bridge until they can be inspected.
- Inspect the Tower Lobbies and Mezzanines to verify that evacuation routes for Stairs A, B and C are clear.
- Inspect for inoperable or jammed egress doors and obvious cracks in plaster ceiling above these areas to determine whether any danger exists overhead.
- Dispatch staff to inspect PATH tunnels (with PATH personnel) via emergency exit stairs in north and south projections.

Mechanical Section

- Verify the integrity of fire protection systems.
- Secure central steam system, River Water Pump Station and gas services as appropriate.
- Inspect mechanical equipment and initiate any necessary repairs.

Electrical Section

- Check integrity of high-tension distribution system.

CHAPTER 13

POWER FAILURES

CHAPTER 13

POWER FAILURES

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POWER FAILURES

13-1 SUMMARY

13-1.1 SCOPE

This procedure covers the response to power failures, including re-entry for essential tenant staff and their representatives. For purposes of this chapter, power failures are defined as a complete lost of lighting and power from one or more substations.

13-1.2 MAJOR RESPONSIBILITIES

General Managers, Managers, and all Supervisory Staff

- When alerted to a power failure, will respond to the Operations Control Center "Situation Room" to oversee emergency response procedures.

Life Safety and Security

- Depending on the circumstances and activities, staff will respond to the appropriate Fire Command Station, or scene.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- Dispatch "key runs" as appropriate.
- Make all appropriate notifications (OCC).

Police

- Perform police duties related to the safe and orderly evacuation of the facility.

Operations and Maintenance Management

- **Mechanical Section** - Operate life safety support systems on emergency power; secure all other nonessential mechanical systems.
- **Electrical Section**: Operate emergency generator plant systems; determine scope of power failure; attempt to restore power.
- **Structural Section**: Supervise staff and carpenters; provide support services as requested.

13-2.7 DIRECTORS OFFICE, GENERAL MANAGERS AND MANAGERS

- Supervise the overall evacuation (refer to Exhibit 13B, Appendix C, Concourse Evacuation, Appendix D Observation Deck Evacuation and Appendix K Subgrade Evacuation).
- Based on the recommendations of Fire Safety, Mechanical, Electrical and Facility Engineering Sections regarding the performance of building life safety systems and other systems, the senior manager on duty determines when the building can safely be re-entered by essential tenant staff and their representatives and finally when the building can be restored to normal operation.

Vertical Transportation

- Direct elevator maintenance contractor to deploy staff for emergency elevator use and repair.

Property Management

- Act as WTC Liaison Officer.
- Coordinate with appropriate WTC Units on issues impacting tenants.
- Disseminate information to tenants.
- Assemble volunteer World Trade Department staff in anticipation of possible need by various units during business hours.

FDNY Bureau of Emergency Medical Services

- Establish EMS/medical treatment center in lobbies or other appropriate areas.

13-1.3 NOTIFICATIONS

The initial report of a power failure will be made to the Operations Control Center identifying the extent of the incident.

All notifications are to be made by the Operations Control Center Supervisor and the Police Desk Officer and are listed in Exhibit 13A.

EXHIBIT 13A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM	TO
OCC	Life Safety & Security Supervisor Police Desk Electrical Contract Supervisor Elevator Maintenance Contract Supervisor Mechanical Contract Supervisor Fire Safety Director Security & Life Safety Director Manager, Operations & Maintenance Management PA Maintenance Supervisors Supervising Engineer Appropriate Property Manager(s) All individuals listed in "Power Failures" paging group
Police Desk	Supervisor Central Police Desk Public Affairs FDNY/EMS
All WTC Division Managers	All Division staff

EXHIBIT 13B
ELEVATOR & BUILDING EVACUATION PROCEDURES

PASSENGER/FREIGHT ELEVATOR EVACUATION PROCEDURE

Advance Notice Available

Whenever advance notice is given of an impending power failure, the senior Property Manager on duty determines if the building(s) should be evacuated before the power failure takes place. The emergency generator plant must be operated immediately and ready to take the extra electrical load when the power failure occurs. To avoid passenger entrapment in elevators, all non-critical elevators should be recalled on normal power using fire service, phase 1, prior to the impending power failure.

Power Failure

Nine elevator emergency power panels exist and are used to evacuate passengers from stalled elevators. They are located as follows:

1 WTC	Zone I	Lobby elevator starter's console
	Zone II	44th floor elevator starter's console
	Zone III	78th floor elevator starter's console
2 WTC	Zone I	Lobby elevator starter's console
	Zone II	44th floor elevator starter's console
	Zone III	78th floor elevator starter's console
4 WTC	(All elevators)	Lobby starter's panel (Concourse Level)
5 WTC	(Elevators 1-6)	Lobby starter's panel (street level)
	(Elevators 7-9) -	Lobby starter's panel (street level)

All panels are accessible with a "1620" (Fire Service) key. If no key is available at the panels, one can be located in the break-glass box at the lobby level elevator starter's consoles in Towers One and Two.

Upon loss of normal power, the World Trade Center emergency generators automatically start and supply emergency power to the elevator systems detailed in the section below. When emergency power is available, a red emergency power light will illuminate in each emergency power panel.

Evacuation Procedures

[redacted]

1. Critical elevators
2. Shuttle elevators
3. All other elevators

The goal is to obtain prompt use of critical elevators for emergency and mobility restricted evacuation followed by the use of shuttle elevators for skylobby evacuation and, finally, local elevators for evacuation of those occupants who chose not to use the stairways.

Critical Elevators 5, 17, 48, 49, 50, 6, 7, 99, J-1 (1 WTC), K-5 (2 WTC), FE10 (5 WTC) and CE-2 (4 WTC) should automatically switch over and operate on emergency power. If any of these elevators are out of service, Staff must select an alternate elevator by manually using the applicable emergency power panel to insure emergency elevator service is established and maintained to all floors for the duration of the emergency.

Due to the limited amount of emergency power available, power can only be supplied to the above critical elevators and, concurrently, all of the following <u>non-critical elevators</u>:

1 & 2 WTC,	Zone I	1 high rise shuttle elevator
		1 low rise shuttle elevator
		1 local elevator
		1 subgrade freight elevator
	Zone II	1 local elevator
	Zone III	1 local elevator
4 WTC		1 high rise passenger elevator
		1 low rise passenger elevator
		1 freight elevator

(note: The FE1 & FE2 elevators are not equipped to run on emergency power).

5 WTC	(elevators 1-6)	1 passenger elevator,
5 WTC	(elevators 7-9)	1 passenger elevator
		1 freight FE10 or FE11

The emergency power evacuation procedure is posted in each panel. Generally, the procedure is as follows:

1. Open the panel and verify that emergency power is available (red light is illuminated). Immediately notify the Operations Control Center if the light is not illuminated.
2. Press the reset button for each group of elevators in the panel.
3. Press one button at a time in each group of buttons in the panel, preferably in order. The buttons are mechanically interlocked so no more than one in each group may be pushed at one time. The actual sequence can vary based on

the specific nature of individual entrapment. However, it is desirable to clear one bank at a time to more efficiently utilize elevator maintenance staff and electrical staff.

4. Verify elevator motion by observing the car position indicators at the console to see that the selected elevators are returning to the lobby. The digital LED's of the selected car should flash alternately between car position and "EMP". Immediately notify the Operations Control Center of the elevators that do not return to the lobby. Elevators not returning to the lobby may be malfunctioning or may have been out of service prior to the power failure. This can be verified by the elevator maintenance contractor. Stentofon contact should be attempted. Each man returning elevator must be instructed to verify that it is [illegible]

5. When the elevators reach the lobby, its doors should open automatically.

Police

- Request the expertise of the elevator contractor to determine if it is feasible to mechanically drift the elevators up or down to the nearest landing.

NOTE: Mechanical evacuation of elevators by drifting must be performed very carefully and only if absolutely necessary, (power will not be available extended periods, medical emergencies, etc.).

BUILDING EVACUATION PROCEDURES

General

The senior manager on duty will determine if building(s) should be evacuated.

Critical elevators shall be utilized for emergency response in this order of priority:

- Fire
- Police
- Medical
- Building staff
- Evacuation of mobility restricted occupants
- Evacuation of all other occupants

Should additional emergency elevators be needed, non-critical elevators can be reassigned as critical elevators.

While the evacuation of passengers from stalled elevators is underway, those occupants remaining in the affected building(s) must be evacuated, primarily using the stairways. Critical elevators should be utilized for emergency response and mobility restricted occupant evacuation and should be coordinated with

cleared in an elevator zone, can local elevators be placed in service for evacuation.

Critical elevators serve all floors and are used to transport building employees responding to the emergency and for evacuation of mobility restricted occupants. Staff shall prioritize the evacuation of shuttle elevators to facilitate the transportation of mobility restricted and others from skylobbies and lobbies. All elevators shall have operators assigned by the General Operations Supervisor.

Plaza Buildings

Stairways are used to evacuate the Plaza buildings. Elevators (No more than one per group) can be operated by manual selection of the elevator select button in the emergency power panel for fire, medical or police emergency, evacuation of the mobility restricted and to transport building employees responding to the emergency.

Mall

For Mall evacuation procedures, refer to Appendix C.

Building Evacuation Completion

When evacuation of the towers is complete, the non-critical elevators still in operation will be parked at their lowest terminal stops and secured. Certain critical elevators including elevator car 50 are to be in operation at all times. Once limited re-entry is authorized and tenants and their representatives reoccupy floors, required freight elevators will be operated.

STAFF DEPLOYMENT - GENERAL

The senior Port Authority staff member on the scene shall coordinate the emergency and deploy available Port Authority and contract staff to lobbies, skylobbies, Mall areas and stairways to conduct an orderly elevator and building evacuation. Building evacuations shall be coordinated with the Fire Safety Director/Fire Command Station. Available staff are temporarily assigned to special duty by their Section Chief or Division Manager. Whenever possible, a World Trade Center management staff member shall be assigned to each lobby and skylobby to direct operations and assess the elevator and building evacuation effort for each particular zone, keeping the Operations Control Center

under their direction, shall be deployed to the street level lobby of One, Two, Four and Five World Trade Center, adjacent to the entry checkpoints to resolve re-entry problems with tenants and their representatives. Security staff will allow essential tenant staff with proper identification to re-enter, keeping a written log of all re-entries.

NOTE: NO ONE is allowed re-entry until it is determined that the building is safe for limited re-entry.

Property Management staff report to the Situation Room to initiate personal and recorded telephone message statements to tenants and to assemble volunteer staff in anticipation of need by Life Safety & Security and Operations & Maintenance Management.

Operations and Maintenance Management staff determine if emergency systems are functioning properly and report problems and their status to the Operations Control Center. Unassigned staff (including supervisors and carpenters) shall report to an announced location for temporary reassignment and deployment.

The Police Division ranking supervisor on the scene shall handle police related matters and deploy police staff to lobbies, skylobbies and concourse areas.

All General Managers and Managers will report to the Operations Control Center and/or Situation Room.

Refer to specific responsibilities contained in this chapter and other chapters of the Emergency Procedures Manual for further responsibilities.

EXHIBIT 13B
ELEVATOR & BUILDING EVACUATION PROCEDURES
PUBLIC AREA STAFF RESPONSIBILITIES

Staff Locations	Responsibilities
Operations Control Center	Coordinate emergency
Lobbies: 1, 2, 4, 5 WTC 1, 2, 4, 5 WTC Total: 8 locations	Evacuate stalled elevators Prevent overcrowding by directing people to Mall and outdoors Report lighting or other deficiencies to OCC Supervise re-entry, once authorized
Skylobbies: 1, 2 WTC - 44 Fl. 1, 2 WTC - 78 Fl.	Evacuate stalled elevators Prevent overcrowding by directing people to stairways Establish queuing lines to shuttle

Floors being evacuated: 1, 2 WTC - 6 zones 4, 5 WTC - 2 zones Total: 8 locations	Inspect floors, one at a time, to verify disabled and others are evacuated and doors to tenant spaces are locked Note whether emergency lighting and public address systems are operational and report deficiencies to OCC
Concourse: See Appendix C Total: 8 locations	Direct people to subways and outdoors Report overcrowding to OCC

EXHIBIT 13C
RE-ENTRY CHECKLIST

The following is the guideline to be used by the senior manager on duty during a power failure to determine whether a limited re-entry procedure should be allowed to one or more floors or buildings. The request to allow Essential Persons re-entry to certain floors originates with the Property Management staff in the Emergency Tenant Communications Office.

1. Are standpipe, sprinkler and smoke detection systems operational in areas to be reoccupied? *(Check with Fire/Life Safety, Mechanical and Electrical).*

2. Has it been verified that the public address system is operational in areas to be reoccupied? *(Check with Fire/Life Safety and Electrical).*

3. Are emergency lighting systems operating in the areas to be reoccupied? *(Check with Fire/Life Safety and Electrical).*

4. Are emergency lighting systems operating in the adjacent corridors and stairways? *(Check with Fire/Life Safety and Electrical).*

5. Is elevator capacity available to transport occupants in and out of the space? *(Check with Vertical Transportation and O&MM).*

6. Are building staff fully deployed and ready to accept occupant re-entry? *(Check with Life Safety & Security and O&MM).*

7. Is the emergency generator plant operating normally with at least one standby generator? *(Check with Electrical)*

8. Is someone assigned to keep a log of who enters the building and what space they will occupy? *(Check with Life Safety & Security.)*

13-2 RESPONSE

13-2.1 LIFE SAFETY AND SECURITY

- Depending on the circumstances and activities, respond to the appropriate Fire Command Station, or scene, and assume fire safety responsibilities.
- If necessary, coordinate activities with the New York City Fire Department and other emergency response personnel.
- Initiate evacuations, if necessary.
- Direct use of public address announcements, if necessary.
- Deploy security officers to secure area(s) and deny access to unauthorized individuals.
- If necessary, authorize issuance of temporary or special identification cards.
- If necessary, authorize issuance of temporary parking permits for responding emergency personnel.
- If necessary, make contact with appropriate individual to obtain emergency cellular telephone service.
- Dispatch "key runs" as appropriate.
- If necessary, call in off duty staff to assist in emergency.

Operations Control Center Supervisor

- Make all notifications listed in Exhibit 13A.
- Acknowledge emergency calls from each stalled elevator using the Stentofon elevator intercom system.
- Monitor radio communications and broadcasts announcements as necessary.
- Report electrical and mechanical problems to the appropriate sections.
- To reduce the anxiety of visitors at public facilities at the World Trade Center, including Windows on the World and the Top of the World Observation Deck, notify the Restaurant and Observation Deck Managers/Supervisors as appropriate, so they are aware of facility emergency. This is necessary when numerous emergency vehicles respond to the building entrances.

13-2.2 POLICE

Supervisor

- Cancel all relief periods and evaluates personnel needs.
- Deploy personnel to areas of high priority in order to obtain the maximum effort in assistance.
- Direct the Desk Officer to make the proper notifications to the Central Police Desk and Public Affairs.
- Request additional Police support from the Central Police Desk, if necessary.
- As requested, assist in the evacuation. See Exhibit 13B.

Note: In assigning extra Police personnel who are not familiar with the complex, the Police Supervisor will insure that a responsible WTC staff member (Security Officer, Supervisor or other management staff) is assigned with these officers.

Posts

Each post reports to their designated location:

Post 1 - Concourse, 1 WTC
Post 2 - Concourse, 2 WTC
Post 4 - Main Lobby , 4 WTC
Post 5 - Main Lobby, 5 WTC
Post 10 - Concourse
Post 9 - 1 WTC lobby and First Aid area.
Post 10 - 44th floor Skylobby 1 WTC
Post 11 - 44th floor Skylobby 2 WTC

Note: Post 9, 10, 11 are available during business hours only.

Take related reports, supervise first aid rendered to injured persons and follow directions of Tour Commander unless stated otherwise.

Desk Officer

- Make all appropriate notifications listed in Exhibit 13A.
- Maintain a chronological log of events.
- Guided by the Tour Commander, deploy Police personnel to critical areas. Refer to Exhibit 13B - public area staff responsibilities.

13-2.3 OPERATIONS and MAINTENANCE MANAGEMENT

Duty Supervisor

- After receiving notification of a power failure, supervise the response to the emergency, keeping management staff apprised of the situation.
- Assign and supervise available building staff.
- If necessary, request Life Safety and Security to restrict the entry of passenger vehicles into the World Trade Center.
- insure all ramp doors are open to facilitate proper ventilation of the subgrade.
- Implement elevator and building evacuation (Exhibit 13B), Concourse evacuation (Appendix C) and building re-entry (Exhibit 13C).
- Secure ACM abatement floors and prevents re-entry.

Mechanical Section

First Priority:

- Check B6 Level "Joy" air compressors; place system in "domestic water cooling mode".
- Check B6 Level "Fire Alarm Communications and Emergency Public Address System" amplifier room air conditioner units; place units in "domestic water cooling mode".
- Respond to 1 & 2 WTC, B1 Level pump rooms; place sprinkler and fire pumps on emergency power and test operation.

Second Priority:

- Assign staff to River Water Pump House to place equipment in "safe" position; lower sluice gates to minimum position, monitor water levels and set equipment in position for startup.
- Insure River Water Pump Station has emergency power.
- Assign staff to Refrigeration Plant to place in "safe" condition. Secure valves and associated equipment in preparation for startup.
- Monitor sump #5 operation to insure proper elimination of steam condensate and generator cooling water.
- Check operation of B6 level "J" and "K" area sumps and ejectors; Use gasoline driven pumps and hoses in event of overflowing.
- Check operation of 4 & 5 World Trade Center sumps and ejectors.
- Report to Operations Control Center when Mechanical 1st and 2nd priority check list is completed.

Electrical Section

NOTE: In the event of a facility-wide power failure, all electricians respond to the electrical shop (except for the Generator Plant Response Team who respond directly to the Generator Plant). If the building in which the shop is located is the scene of the emergency all electricians shall respond to:

Corner of Church & Liberty Streets (if inaccessible, report to Church & Fulton Streets, in front of 5 World Trade Center).

First Priority:

- One electrician responds to Emergency Generator Plant to insure the proper

- Check city water pump operation.
- Check generator room air compressor operation.
- Check WTC and NYNEX generator exhaust fans S-13 & S-24.
- Place "joy" air compressors on emergency power.
- Check that all Sump #5 pumps have transferred to emergency power.
- Verify that all automatic transfer switches are properly positioned for emergency use. Manually transfer switches as needed.
- Inspect engines on line. Check for leaks excessive vibration and noise.
- Check fuel level in day tanks.
- Open sound proof booth and prepare to operate from booth.
- Check emergency power feed to the TV Broadcasters transformer.
- Contact Con Edison to learn when restoration of power will likely occur and advise Operations Control Center.

Second Priority:

- Check that the electrical systems in the Operations Control Center and Police Desk are functioning properly.
- Check that the maintenance shops and offices are completely on emergency power.
- Check that elevator maintenance contractors shops and offices are operating on emergency power.
- Place all subgrade MCC boards on emergency power; restart fans.
- Report to the Operations Control Center when both the 1st & 2nd priority check lists are completed.
- Compile a list of all reported public area lighting and public address system deficiencies for use by the manager to determine if limited occupant re-entry shall be authorized.

13-2.4 VERTICAL TRANSPORTATION

Elevator Maintenance Contractor

- During business hours, direct the maintenance mechanics to their assigned emergency posts.

Posts	Locations
1	1 WTC, Zone 1, Bank D
2	1 WTC, Zone 2, Bank D
3	1 WTC, Zone 3, Bank C
4	1 WTC, 47th F1, shuttle machine room
5	1 WTC, 81st F1, shuttle machine room
6	2 WTC, Zone 1, Bank D
7	2 WTC, Zone 2, Bank D

8	2 WTC, Zone 3, Bank C
9	2 WTC, 47th F1, shuttle machine room
10	2 WTC, 81st F1, shuttle machine room
11	Operations Control Center

Direct staff to:

- Immediately check to assure that the critical elevators are operating.
- Assist the Police in conducting rescues involving elevators which cannot be operated.
- Assure that all non-critical elevators have been secured in the lobby with the doors open.
- Assist in evacuation. (refer to Appendix C for Concourse evacuation procedures).

13-2.5 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.
- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

13-2.6 FDNY EMERGENCY MEDICAL SERVICES

- As requested, establish a medical/first aid center in lobby of the affected building, equipped with cots, blankets and medical supplies.
- Arrange for additional staff from nearby hospitals and/or 911 dispatcher.

CHAPTER 14

STRUCTURAL INTEGRITY

CHAPTER 14

STRUCTURAL INTEGRITY

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STRUCTURAL INTEGRITY

14-1 GENERAL INFORMATION

14-1.1 SCOPE

This procedure covers the response to potential and actual structural integrity failures. Typical failures include sagging ceilings, cracked and displaced stone panels, spalled concrete or any other failure which could cause substantial risk of harm to the public or other users.

14-1.2 MAJOR RESPONSIBILITIES

Operations and Maintenance Management

- **Supervising Engineer**: Manage response to potential and actual structural integrity failures and determine if an evacuation is required. Arrange for and evaluate the design of repairs.
- **General Maintenance Section**: Arrange for repair work to be performed as requested. Assist in performing engineering inspections as requested.

Quality Assurance Division

- As requested, make the initial on-scene assessment as to whether the structural condition requires immediate response.

Construction Division

- As requested by the Supervising Engineer, perform remedial and permanent repairs such as demolition and other work.

Life Safety and Security

- At the request of the Supervising Engineer, deploy security staff to secure affected or evacuated areas, floors, zones, etc. to prevent access by unauthorized individuals and to prevent reoccupancy.

Police

- As requested, assist in evacuating and securing the affected area(s).

Property Management

- Act as WTC Liaison Officer.
- Disseminate information to tenants.

- If necessary, a representative from Media Relations will also be in the lobby to field questions from the media/press.

14-2 RESPONSE

14-2.1 OPERATIONS and MAINTENANCE MANAGEMENT

(Structural Integrity Coordinator/Structural Engineer)

1. Upon notification of a potential or actual structural integrity failure respond to the affected location and determine if the condition requires further specialized investigation.
2. If further investigation is required, contact the Quality Assurance Division to have the condition inspected.

A) If determined as an ***immediate*** structural integrity problem, coordinate emergency remedial measures.

- Request an immediate evacuation of the affected area (using Security Officers or Police Officers if necessary).
- Initiate a thorough investigation and evaluation.
- Make notifications (see Exhibit 14A).

B) If determined as a **priority** problem, coordinate remedial measures.

C) If determined as a **routine**, direct the Operations & Maintenance Management General Maintenance Section and/or the Construction Division to make the appropriate repairs.

Note: It is the responsibility of the Quality Assurance Division to determine if the problem is Immediate, Priority, or Routine; not the Supervising Engineer.

3. Make notifications as per Exhibit 14A.
4. If the problem does not require further investigation, direct the General Maintenance Section and/or the Construction Division to perform the necessary repairs.

General Maintenance Section

- Report all structural integrity concerns to the Supervising Engineer.
- Perform any requested remedial work.

Note: No section member has the authority to determine whether a structural integrity situation is immediate, priority or routine. This determination is made by the Quality Assurance Division.

Managers Office

1) With the advice of the Supervising Engineer and the Quality Assurance Division, determine if a space can be reoccupied.
2) If required, authorize further investigation of the condition by the structural consultant and ensure that remedial measures are implemented.

14-2.2 QUALITY ASSURANCE DIVISION

1) When requested by the Supervising Engineer, respond immediately to affected area.

2) Make an initial assessment determining if the condition is:
- Immediate (requiring evacuation & immediate response)
- Priority
- Routine

3) Provide technical advice to the Supervising Engineer.

14-2.3 CONSTRUCTION DIVISION

1) When requested by the Supervising Engineer, perform remedial work.

14-2.4 LIFE SAFETY AND SECURITY

1) At the request of the Supervising Engineer or Operations and Maintenance Management, assist in the evacuation and securing of area(s).
2) Deploy security staff to secure evacuated areas, floors, zones, etc. to prevent access to unauthorized individuals and to prevent reoccupancy.
3) If necessary, initiate evacuations.
4) Direct use of public address announcements.
5) If necessary, authorize the issuance of temporary or special identification cards.

14-2.5 POLICE

- As requested, assist in evacuating and securing the affected area(s).

14-2.6 PROPERTY MANAGEMENT

- The General Property Manager responsible for the property involved in the incident will assume full responsibility as the WTC Liaison Officer and will be stationed in the lobby at the Fire Command Station/Elevator Console area.
- The General Property Managers from the other buildings along with the Senior Property Manager and staff of the affected property will assist the Liaison Officer in the lobby.
- The Senior Property Managers and their staff from the unaffected properties will report to the Situation Room and Property Management Office at the Operations Control Center and activate all telephones, computers and the Emergency Tenant Notification System.
- The Senior Property Managers will assume all responsibility for disseminating all pre-cleared information to staff and tenants. One staff member will act as the official scribe, maintaining a constant record of events as they occur.
- The Liaison Officer will be responsible for notifying the Chief Operating Officer and Media Relations, if applicable, and will work closely with Senior World Trade and Port Authority Staff as well as all World Trade Center Units – Life Safety & Security, Police, Vertical Transportation, Engineers Office, Central Systems, General Maintenance, Locksmith Shop, Construction, Project Management and Operations Management.

14-1.3 NOTIFICATIONS

- All reports of potential and actual structural integrity failures are made to the Supervising Engineer pursuant to Exhibit 14A.

EXHIBIT 14A
NOTIFICATIONS

Refer to Appendix A for names and telephone numbers.

Individuals or their alternates must be paged and/or contacted at home if the incident occurs off-hours.

FROM		TO
OCC		Supervising Engineer Manager, Operations & Maintenance Management O&MM Duty Supervisor Life Safety and Security Supervisor Security & Life Safety Director Fire Safety Director Appropriate Property Management staff All individuals listed in "Structural Integrity" paging group
Supervising Engineer		
	Immediate response required also notify:	Project Manager, Quality Assurance Manager, O&MM Manager, Quality Assurance Division Life Safety & Security Supervisor Security & Life Safety Director Fire Safety Director Operations Control Center Director's office Manager, WTC Construction, Project Appropriate Property Management staff

APPENDIX A - O

The Incident Command System was developed as a result of major wildland fires in Southern California in the 1970's. As a result of these fires, a need was identified to develop a system whereby various agencies could work together towards a common goal in an effective and efficient manner. The initial organization was known as "Firefighting Resources of California Organized for Potential Emergencies" (FIRESCOPE). Organizational difficulties involving multi-agency responses were identified and addressed by developing the original Incident Command System for effective incident management.

The Incident Command System is a system designed to begin developing from the time an incident occurs until the requirement for management no longer exists. The title of "Incident Commander" is a title which can apply to various individuals depending on the situation and type of command structure used. The structure of the Incident Command System can be established and expanded depending upon the changing conditions of the incident. It is intended to be staffed and operated by qualified personnel from emergency services agencies and may involve personnel from a variety of organizations. To be effective, an incident management system must be suitable for use regardless of the type of jurisdiction or agency involved. The organizational structure must be adaptable to any incident and capable to expansion from the initial response to the complexities of a major event.

Emergency management is generally carried out in a constantly changing environment. Although the situation may get better or worse, it seldom stays the same. In addition to other emergency issues, the dynamics of a constantly changing environment present additional challenges to the Incident Commander and the effectiveness of the incident plan depend on factors which may be difficult to assess or confirm. A situation may require frequent shifts from an offensive to a defensive mode as changes in priorities occur during the assessment of life safety, incident stabilization and property conservation concerns.

APPENDIX O

INCIDENT COMMAND

INCIDENT COMMAND SYSTEM OVERVIEW

APPENDIX INDEX

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N Media Relations and Public Release of Port Authority Information

O Incident Command

APPENDIX A

TELEPHONE NUMBERS

APPENDIX B

MAPS

Flammable liquids with limited solubility in water must be handled differently. It is recommended to dike large spills and remove the remaining liquids by pumping into salvage or recovery tanks.

Flammable chemicals must not be "flushed" down sewers. Such action may cause an explosion as previously described.

If the chemical spill is a liquid, the spillage should be contained with sand, absorbent clay, or "speedy dry". If it is a solid, it should be contained by covering with a heavy polyethylene sheet and weighting edges and corners with sand. If the incident involves a gas, tanks exposed to fire should be kept cool with water spray while allowing them to empty on their own.

While safety is the first priority in responding to any accident, thinking safely is even more important when hazardous materials are, or might be involved in the incident. It is essential to know the properties of the materials involved. The scene of an accident involving hazardous materials could represent such a high degree of hazard that the only safe course is to protect the perimeter and evacuate those who may become exposed. **DO NOT** enter the scene until proper identification of the hazardous material has been made. Even full "turn out gear" including Self Contained Breathing Apparatus may not be sufficient protection in some cases.

Handling of hazardous materials incidents cannot be compared to normal fire fighting operations. Unlike other emergency situations, a chemical release requires special talents and training, which are uncommon to, and beyond the capabilities of all but specially trained units.

All actions taken must be planned after properly identifying the substance(s) involved. The planning procedure is time consuming but essential to the preservation of life and protection of property. If the emergency involves hazardous materials, assistance from the chemical manufacturer, transporter and from local state and federal agencies is generally available 24 hours per day, 7 days per week.

"Rushing in" to a hazardous materials incident in an irresponsible manner without first obtaining the facts will only result in unnecessary risk, exposure, and possible injury or death to responding personnel.

IDENTIFICATION OF HAZARDOUS MATERIALS

GENERAL PROCEDURES

Upon discovery of any incident immediately make notification of:

- The type of event

- Specific location
- Vehicle(s) involved (if any)
- Apparent life hazards

Make an initial survey of the scene to determine:

- Location of threatened, or potentially threatened, people
- Presence of fire, smoke, fumes, or pools of liquid
- Overall condition of vehicles and/or containers
- Wind direction, if outdoors
- Proximity to drains, waterways, etc.
- Visible placards, labels chemical names, identification numbers, symbols, or other information on container, tank, drum, or vehicle
- Note of any leaks, odors, spillage's, vapors, etc.
- Speak to driver, if possible. Ask the name of the material involved
- Relay additional information to Hazardous Materials Unit.

Attempt to verify information by checking shipping papers for:

- Name of product
- Hazard class
- United Nations hazard identification number(s)
- Any other indication that the materials being transported are hazardous

Obtain as much information as possible to assist in identification. When relaying information, be exact. Spell the chemical name accurately. One letter can make a tremendous difference in properties and hazards. Recognizable signs such as vapor clouds, liquids, odors, fuming, etc., may or may not be present. The chemical involved could be odorless, colorless, or have invisible vapors. **DO NOT ASSUME THAT NO CLEARLY RECOGNIZABLE SIGN MEANS THERE IS NO HAZARD.** Unseen hazards can be the greatest in certain incidents (for example, there is often no detectable warning sign for the presence of a cancer causing agents).

Until the hazardous material has been properly identified and all pertinent information is available, isolate all persons exposed to the material. Isolation will avoid spreading contamination until proper medical treatment has been arranged.

There may be times when an immediate life hazard situation presents itself. Before attempting a rescue, consider the possible risk of making the rescue efforts worse by exposing improperly equipped members to serious injury or death. There may be some situations where rescue efforts cannot be made until proper equipment is available. While some risk may be justified, it must be weighed against the expected results.

DO NOT ATTEMPT TO HANDLE ANY HAZARDOUS MATERIALS INCIDENT UNTIL PROPER IDENTIFICATION HAS BEEN MADE.

Hazardous Material Classifications

Hazardous materials are classified according to hazard characteristics:

- Combustible Liquids
- Compressed Gases (Flammable or nonflammable)
- Corrosive Liquid (acids and alkalis)
- Explosives (Classes A, B & C)
- Flammable Liquids
- Flammable Solids
- Oxidizing Materials (Oxidizers, Oxygen & Organic Peroxides)
- Poisons (Classes A, B & Irritating Materials)
- Radioactive Materials
- Other Regulated Materials (Classes A, B, C, D & E)

COMBUSTIBLE LIQUIDS

Combustible liquids are liquids having a flash point above 100°F and below 200°F, which, when mixed with air, in the presence of a source of ignition, may burn. The primary problems created by combustible liquids are fires, spills, or

COMPRESSED GASES

A compressed gas is any material or mixture having in the container either an absolute pressure exceeding 40 pounds per square inch at 70°F, or an absolute pressure exceeding 100 pounds per square inch at 130°F, or any liquid flammable material having a vapor pressure exceeding 40 pounds per square inch (absolute) at 100°F. Simply stated, a compressed gas is a gas within a container that is under pressure at room temperature. Some examples are oxygen, nitrogen and liquefied petroleum gas.

- A flammable gas a gas under pressure which will form a flammable mixture when released in air. Some examples are hydrogen, carbon monoxide and acetylene.

- A nonflammable gas a gas under pressure which will not form a flammable mixture in air but may support combustion. These gases may be oxidizers, poisons, corrosives, etc. Some examples are carbon dioxide.

- A cryogenic gas is a liquefied gas at a temperature below -328°F. These gases present an extreme cold hazard to the point that they can freeze objects (including parts of the body) to a point of brittleness where impact can shatter the frozen object. Some examples are liquid oxygen and carbon dioxide.

The multiple hazards of compressed gases are a "BLEVE" (boiling liquid expanding vapor explosion), asphyxiation, toxicity, corrosiveness, frostbite, reactivity and the movement along the ground to an ignition source.
The more generally used liquefied petroleum gases (LPG's) - butane, propane and acetylene - account for over 90 percent of the flammable compressed gases that are transported by truck. Upon release as a liquid or gas, all are subject to ignition from many sources, including static electricity. Extreme caution is necessary where these gases are escaping into the atmosphere without burning to consume the gas. When LPG is released from pressure and not burning, it vaporizes, and may be visible as a white cloud. The vapor is heavier than air, and is likely to spread over the area, channel away with the wind, and settle to ground level. The vapor, when mixed with the proper proportion of air, is subject to ignition and vapor cloud explosion. The greatest hazard to personnel when LPG or other flammable compressed gases are released is that of fire or explosion.

If the gas is present in-high concentrations, inhalation may cause nausea or suffocation. For that reason, LPG, in most cases, is odorized so that its presence can be easily detected.

CORROSIVE MATERIALS

A Corrosive material is a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or in the case of leakage form its packaging, a liquid that has a severe corrosion rate on steel.

Corrosive liquids in contact with the body may cause serious or fatal burns.

This commodity classification includes both acids and alkalis which have a harmful effect on personnel, or which react with other materials with which they come in contact. Examples are battery acid, sulfuric and nitric acids.

Corrosives present multiple hazards since they may be toxic, release heat and splatter when diluted with water, become unstable and decompose when heated.

EXPLOSIVES

An explosive is any chemical compound, mixture, or device which results in the instant release of gas and heat. High explosives are substances which detonate, releasing energy very rapidly and creating very high pressure. Low explosives burn at much lower rates, creating lower pressures. There are three classes of explosives:

- Class A explosives are the most hazardous of the three categories. While there are many types, they have one of two general characteristics in common. Action is initiated either by detonation (accompanied by a shock wave) or deflagration, which is instantaneous burning or vaporizing. Examples are black powder, bombs, TNT, dynamite and military ordinance.
- Class B explosives function by rapid combustion rather than by detonation, and include pyrotechnics, flash powders, signal devices, and smokeless powders.

- Class C explosives are manufactured articles which contain Class A or Class B explosives, or both, as components, but in restricted quantities. This class includes small arms, common fireworks, and fuses.

FLAMMABLE LIQUIDS

A flammable liquid is any liquid having a flashpoint below 100°F and which, when mixed with air in the presence of a source of ignition, may burn or explode. Examples are gasoline and lacquer thinners. The primary problems created by these liquids are spills and leaking containers. These liquids may also have characteristics of acidic, corrosive, poisonous or radioactive materials, depending on their composition. Such liquids are generally contained in five gallon or smaller containers; however, the fuel tanks of many trucks may contain more than fifty gallons of gasoline. In the event of an accident, the tank may be ruptured and sizable quantities of gasoline released.

An empty or partially empty container can be more hazardous than a full one because the vapor-air mixture is more susceptible to ignition.

Possible multiple hazards of flammable liquids are the ability to contaminate water, toxicity, corrosiveness, reactivity, BLEVE or BLEVE-like explosion, and open air combustion explosion.

FLAMMABLE SOLIDS

A flammable solid is a substance other than an explosive (which can cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily) and when ignited, burns so vigorously and persistently as to create a serious transportation hazard. This category includes: 1) dusts or fine powders (metals, cellulose, flour, etc.); 2) those that ignite spontaneously at low temperatures (white phosphorus) and 3) films, fibers and fabrics having a low ignition point.

These materials are not hazardous to personnel as long as there is no fire, or certain quantities of the materials are spilled. When a fire does occur, many of the materials in this category become extremely hazardous, and burn at an accelerated rate. Spontaneously combustible substances ignite due to retained heat, oxidize to generate heat and ignite, or absorb moisture to generate heat and ignite. Pyrophoric substances are flammable solids which ignite spontaneously in contact with air at normal temperatures and do not require any other ignition source (white phosphorus, titanium dichloride).
Water reactive solids will chemically react with water to become spontaneously flammable or to give off flammable or toxic vapors.

Air reactive materials will ignite at normal temperatures when exposed to air. White phosphorous, a flammable solid is an example. Four potential multiple hazards of flammable solids are:

- They ignite easily and burn with explosive violence.
- They react with air and water (should be labeled "Dangerous When Wet").
- They may produce toxic or corrosive compounds.
- They may initially be toxic or corrosive themselves.

OXIDIZING MATERIALS

An oxidizing material is a substance that yields oxygen readily and stimulates the combustion of organic matter. When combined with certain other materials, or when burned, this material releases oxygen which accelerates the burning process, and may result in explosions. Most oxidizers shipped as liquids will cause fire by contact with combustible materials.

Organic peroxides heated above their transportation temperatures are likely to explode. If an accident occurs involving a refrigerated truck carrying organic peroxides and refrigeration is lost, there is a strong possibility that an explosion will occur. Call for assistance and follow appropriate procedures.

In addition to supplying oxygen, oxidizers have other hazards: some are explosively sensitive to heat, shock or friction and some react with combustible organic materials rapidly enough to cause spontaneous combustion. Most oxidizers will form an easily ignited or explosive mixture when united with finely divided organic materials.

POISONS

Poisons are substances which in very small amounts are capable of causing injury to susceptible tissues by a chemical actions. Poison can enter the body by inhalation, absorption and ingestion, and are divided into three groups described as follows:

- Poison A materials are extremely dangerous poisons consisting of poisonous gases or liquids of such nature that a very small amount of the gas, or vapor of the liquid, mixed with air is dangerous to life.

- Poison B materials are less dangerous poisons consisting of substances, liquids or solids (including pastes and semisolids), other than Class A poisons or irritating materials, which are known to be so toxic to man as to afford a hazard to health during transportation; or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man.

- Irritating Materials are liquid or solid substances which upon contact with fire or when exposed to air give off dangerous or intensely irritating fumes.

It is important to recognize that a poison may be a gas or liquid of which only a very small amount of gas or vapor form the liquid mixed with air will be dangerous to life. Empty poison containers are extremely dangerous due to remaining residue.

RADIOACTIVE MATERIALS

A radioactive material is any material or combination of materials, that spontaneously emits ionizing radiation, and having a specific activity greater than 0.002 microcuries per gram.

Government regulation require that nearly all radioactive materials packages be labeled. Packages with a RADIOACTIVE WHITE-I label have almost no radiation outside the package; packages with a RADIOACTIVE YELLOW-II label

have low radiation levels; and packages with a RADIOACTIVE YELLOW-III label have higher radiation. The radiation levels allowed outside packages are limited by Federal regulations. Radioactive material may look like any other material - that is, it is in the form of a solid, liquid, gas, powder, etc.

If radioactive material leaked out of a package because of an accident, it would constitute radioactive contamination and it behaves like any other contamination, such as a chemical spill in that it can become airborne, be tracked and spread. It will contaminate objects or people that it comes in contact with.

OTHER REGULATED MATERIALS

Other Regulated Materials (ORM) are hazardous materials that are regulated because they pose an unreasonable risk to health and safety or property, but they do not meet the definitions of other hazard classes in the DOT hazardous material regulations. ORM's are subdivided into five categories as described below:

- ORM-A is a material which has an anesthetic, irritating, noxious, toxic, or other similar property and which can cause extreme annoyance or discomfort to passengers and crew in the event of leakage during transportation.

- ORM-B is material (including a solid when wet with water) capable of causing significant damage to a transport vehicle or vessel from leakage during transportation.

- ORM-C is material which has other inherent characteristics not described as an ORM-A or ORM-B but which make it unsuitable for shipment, unless properly identified and prepared for transportation. Each ORM-C material is specifically named by federal regulation in the CFR Title 49.

- ORM-D is a material such as a consumer commodity which, though otherwise subject to the regulations if this subchapter, presents a limited hazard during transportation due to its form, quantity and packaging.

- ORM-E is a material that is not included in any other hazard class but that is subject to the requirements of the DOT regulations. Materials in this class include "hazardous waste" and other hazardous substances.

APPENDIX O

INCIDENT COMMAND

INCIDENT COMMAND SYSTEM OVERVIEW

The Incident Command System was developed as a result of major wildland fires in Southern California in the 1970's. As a result of these fires, a need was identified to develop a system whereby various agencies could work together towards a common goal in an effective and efficient manner. The initial organization was known as "Firefighting Resources of California Organized for Potential Emergencies" (FIRESCOPE). Organizational difficulties involving multi-agency responses were identified and addressed by developing the original Incident Command System for effective incident management.

The Incident Command System is a system designed to begin developing from the time an incident occurs until the requirement for management no longer exists. The title of "Incident Commander" is a title which can apply to various individuals depending on the situation and type of command structure used. The structure of the Incident Command System can be established and expanded depending upon the changing conditions of the incident. It is intended to be staffed and operated by qualified personnel from emergency services agencies and may involve personnel from a variety of organizations. To be effective, an incident management system must be suitable for use regardless of the type of jurisdiction or agency involved. The organizational structure must be adaptable to any incident and capable to expansion from the initial response to the complexities of a major event.

Emergency management is generally carried out in a constantly changing environment. Although the situation may get better or worse, it seldom stays the same. In addition to other emergency issues, the dynamics of a constantly changing environment present additional challenges to the Incident Commander and the effectiveness of the incident plan depend on factors which may be difficult to assess or confirm. A situation may require frequent shifts from an offensive to a defensive mode as changes in priorities occur during the assessment of life safety, incident stabilization and property conservation concerns.

Appendix K
UTILIZATION OF COMPANY HANDI TALKIE AUC 179

DCN: 4.03.06 **A.U.C. 179**
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UTILIZATION OF COMPANY HANDIE TALKIE

Appendix K
Utilization of Company Handie Talkie AUC 179
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SECTION

1. Description of Handie-Talkie.
2. Equipment Distribution and Assignments.
3. Instructions for Utilization of Handie-Talkie MX 330/6 VHF.
4. Security of Handie-Talkie Equipment.
5. Operations with Handie-Talkie Equipment.
6. Maintenance and use of Handie-Talkie Equipment.
7. Repairs to Handie-Talkie's.
8. Frequency Allocation and Use.
9. Battery Chargers.
10. Special Features.

1. DESCRIPTION OF HANDIE-TALKIE

The Handie-Talkie to be used is designated a "MOTOROLA HT 330/6 VHF". It comes equipped with a carrying case and an adjustable shoulder strap to allow for carrying the H.T. on ones person.

Power output is approximately 1 watt, supplied by a rechargeable nickel cadmium (Ni-Cad) battery.

A 5" rubber encased helical antenna makes adjustment of set to body easier and affords greater comfort to wearer.

A frequency selector switch permits the use of 7 channels.

A newly designed microphone clip permits the speaker/microphone to be attached to the shoulder strap by the use of either a snap-in button or to the "turnout" coat by means of a heavy spring loaded clip.

1.1 The H.T. will aid in achieving greater safety, effectiveness and efficiency at fire operations.

2. EQUIPMENT DISTRIBUTION AND ASSIGNMENTS

2.1 H.T. equipment will be distributed as follows:

a. 2 HT to each Division
b. 2 HT to each Battalion
c. 4 HT to Ladder Companies
d. 3 HT to Engine Company and Squad
e. 6 HT to each Rescue Company

2.2 The assignment of HT in Units shall be as follows:

a.	Squad and Engine Company:	Worn by Officer, Chauffeur (ECC) and member designated by company commander.
b.	Ladder Company:	Worn by officer, chauf., roof and ov. position.
c.	Rescue Company:	Worn by officer and all firefighters.

2.3 Each radio depot is issued a full complement of handie-talkies to outfit all units within their jurisdiction. Additionally, a 20% spare pool is issued over and above their regularly assigned sets. Any Division or Depot issuing additional sets over normal assignment levels are required to recall over-issued sets should their spare pool become low or depleted. Radio Repair Operations repair schedule is based on all units having adequate spares, based on official assignments to allow for the timely repair of all Radio Depot's Handie-Talkies. Radio depots with depleted spare pools effect the overall repair process and availability to other units. Extreme diligence and caution should be used when issuing radios over official assignments.

3. INSTRUCTIONS FOR UTILIZATION OF HANDIE TALKIES

3.1 When the turnout coat is worn, the HT will be protected from weather, hose streams, plaster, etc. Reception is slightly reduced by the closed coat. The speaker-microphone will be in a usable position on the shoulder strap if the top snap of the turnout coat is left open. Members must experiment at drill to find out how their coats effect HT usage. If reception or transmission is poor, the speaker-microphone can be removed from its microphone clip and placed higher on the harness by using the spring loaded clip. This should correct the problem.

3.2 To reduce damage to the HT unit and to protect it from adverse weather conditions, the unit must be worn under the turnout coat. This requires that the HT be donned before responding.

3.3 The HT shall also be turned on prior to donning the turnout coat. When control is set at maximum, the volume is too loud and sound quality is poor. Members shall start at the half volume point and adjust volume control if necessary.

3.4 HT's will not be used in any drill or training sessions where use will interfere with an operation in progress. When they are used at drills, any available channel may be utilized.

4. SECURITY OF HANDIE - TALKIE EQUIPMENT

4.1 In Quarters

4.1.1 If recharging is necessary, the HT will be kept in its charger. H.T. WILL BE REMOVED FROM CHARGER BY ASSIGNED H.T. MEMBER AND DONNED UPON RESPONSE OF UNIT TO AN ALARM OR LEAVING QUARTERS FOR ANY OUTSIDE ACTIVITIES. Otherwise, it shall be kept in a secure place on the apparatus. It is imperative that members on housewatch keep unauthorized persons from the vicinity of apparatus. Apparatus floor should never be unguarded while unit is in quarters.

4.1.2 At each change of tours in quarters, the incoming officer of each unit shall have the HT's checked to see that they are functioning, fully charged and properly assigned. An entry of HT equipment check and assignment shall be incorporated with the mask inspection entry in the company journal after roll calls.

4.2 On Fire Ground

4.2.1 During fire or emergency operations, the security problem is reduced since the HT's will be worn by Company Officers and selected firefighters. However, there may be times at operations when the HT will no longer be needed by members (i.e., overhauling, salvage, etc.) and they will perform more freely without them. In such cases, the HT's may be removed provided they can be locked in a safe place on the vehicle. A security guard shall be posted as prescribed in AUC 189.

4.2.2 When units are relieved at operations, the incoming officer of the unit shall assign the HT to designated member or members.

5. OPERATIONS WITH HT EQUIPMENT

5.1 Unit Identity

The H.T. worn by the officer of the unit will be identified by the unit number. A second H.T. used by the same unit will be identified by unit number and the word "Roof". A third H.T. used by the same unit will be identified by the unit number and the word "OVM", and "Chauf.", if fourth H.T. assigned.

Example: Company Officer: "Ladder 120 to Ladder 120 Roof. Have you opened the bulkhead yet? K."

Ladder 120 Roof: "Ladder 120 Roof to Ladder 120. Having difficulty with bulkhead door but skylight is off. K."

Officer: "Ladder 120, Ten-four."

5.2 Feedback Assistance Rescue (F.A.R.)

See Communications Manual chapter 9, section 5 for specific procedures for MX - 330.

6. MAINTENANCE AND USE OF HANDIE - TALKIE EQUIPMENT

6.1 The Officer on duty shall have each Handie - Talkie checked at the start of each tour to insure it is functioning. A momentary transmit sequence will provide a red light on top of the HT and a squelch noise burst when the transmit button is released. This is a basic rudimentary checkout of the HT.

6.2 Officers of units shall conduct company drills utilizing the information contained in appropriate training bulletins.

6.3 If the Handie - Talkie becomes wet at operations, it shall be stored in an upright position when drying, to permit maximum drainage from the power pack of the set. The Handie - Talkie should be turned "off" as soon as possible after becoming wet and shall remain off until H.T. is dry.

If the Handie - Talkie gets very wet or has been submerged in any liquid send it to the Radio Repair Operations to be cleaned in the ultrasonic bath to prevent damage to internal components. The Handie - Talkie should be turned "off" as soon as possible after becoming wet.

6.4 External battery charging contacts at base of Handie - Talkie may be cleaned with an eraser if a coating is observed on the contacts. Never use an abrasive.

Handie - Talkies should be wiped clean of plaster and dust before inserting into battery charger. Foreign matter accumulating in the base of the charger may prevent proper contact from being made.

6.5 The Field Communications Unit shall carry, in addition to its normal complement, 10 additional Handie - Talkie's with fully charged batteries for use at HI RISE building fires. FCU shall keep, in addition to their normal complement, a supply of spare Handie - Talkie's for emergency use in the event a Division is depleted of Handie - Talkie's especially on weekends and holidays. This shall be on a temporary exchange basis and shall be returned to the FCU as soon as they are no longer required

6.6 Every Handie - Talkie operator should check his set after turning it on, and periodically while standing by. A momentary transmit sequence will provide a red light on top of the HT and a squelch noise burst when the transmit button is released. This is a basic rudimentary check out of the HT.

7. REPAIRS TO HANDIE - TALKIE'S

7.1 Repairs to Handie - Talkie's shall be made only at Bureau of Fire Communications, Radio Repair Operations. Handie - Talkie's requiring repairs shall be delivered to the Radio Depot via Division messenger.

7.2 The Radio Repair Operations radio messenger will pick up defective HT's from the Radio Depots and will deliver them to Radio Repair Operations for repair.

7.3 The procedure for returning repaired Handie - Talkie's to units shall be the reverse of the above.

7.4 Each Division will be given a supply of spare Handie - Talkie's for issue to a unit when a unit's Handie-Talkie becomes defective. This Handie - Talkie now becomes a unit's regular Handie - Talkie. Divisions shall provide a secure storage area for these sets.

7.5 Each Division shall maintain the magnetic inventory control board in accordance with instructions received to maintain an accurate inventory for the line Division.

Each Division shall maintain a record of:

1. Each set delivered or received from Radio Repair Operations of Fire Communications.

2. Each set assigned to or received from a unit.

7.6 A tag system will be used to simplify administrative work involved in the repair procedure. Tags will be placed on sets by units when sending them for repairs, identifying the set and listing the repair problem, e.g. (L12O "Reception poor intermittently" or "mike button sticks" etc.). Divisions shall requisition and keep their units supplied with tags.

7.7 When a defective handie-talkie is sent to Radio Repair Operations for repair, the speaker-microphone, antenna and the battery that made up the handie-talkie unit when it became defective, must be included.

8. FREQUENCY ALLOCATION AND USE

8.1

	Channel	Frequency
1	Universal Handie - Talkie	153.83 MHZ
2	City Wide Base	154.43 MHZ
3	Queens Mobile	153.77 MHZ
4	Manhattan Mobile	154.01 MHZ
5	Brooklyn Mobile	153.95 MHZ
6	Staten Island Mobile	154.07 MHZ
7	Hi - Rise Repeater	TX 153.890 CSQ RX 154.430 CSQ

8.2 Channel - number indicated by the control knob at the top of the H.T.

Frequency - indicates the radio band assigned that channel.

Note: Channel 1 is on the same frequency assigned previously to H.T.'s in all Boroughs. Channels 2 through 6 will be operating on frequencies that are also used for communications from mobile field units to the Central Office. To insure that the H.T. system and the apparatus radio system do not interfere with each other, it is imperative that channels be used only as authorized. Channel 7 is a duplex repeater channel that requires a repeater to operate properly. Without a repeater communications on channel 7 is not possible. The order to use channel 7 will come from the officer - in - charge.

8.3 Of the seven (7) frequencies available for use, a maximum of only four may be used at one time in some sections of the city. In other areas, only three frequencies can be used. This is due to interference which would be caused by geographic location, topography, areas near open bodies of water, and the locations of pickup radio antenna. The allocation of available frequencies, as determined by the Bureau of Fire Communications, will be according to Battalion Administrative Districts. After this system has been operational, there may be modifications based on ensuing developments.

8.4 Method of Use for Each Channel

There are four situations which require defining. They are:

8.4.1 Primary Tactical

This is the basic channel. All units in all Boroughs shall operate on this channel until ordered to do otherwise by the Chief in Command of an operation.

8.4.2 Secondary Tactical

This channel is intended for use by units when Channel 1 is being heavily used at a nearby major incident.

The following guidelines will govern its use:

A. The first incident in a Borough that escalates to 7-5 status will have priority use of Channel 1. (Primary Tactical)

B. The Chief in Command of any ensuing incidents in the same area will determine if, and specify when, the Secondary Tactical Channel must be used. The decision will be based on experience with the distance and interference factors involved and the extent he expects the Handie-Talkie's to be used at this second incident. As an example, he would not order the use of this Secondary Tactical frequency if his operation is simple and very little Handie - Talkie traffic is anticipated. The same would apply if the first incident is remote and little or no interference is expected.

C. No set rule can be applied to determine when Handie - Talkie's used at one incident will interfere with a second incident in the same area. Some of the determining factors aside from fire traffic are weather, distance, and terrain. Chief Officers must have sets on while responding, consider all the factors involved, and make a decision based on experience.

D. When the Chief in initial command arrives at an incident and decides to use the Secondary Tactical frequency, he must inform all his subordinate units. The Chief will notify the dispatcher via Department radio of the alternate channel he will place in use. The dispatcher will then broadcast this information to responding units, and again to any units responding on additional alarms.

Examples - In Manhattan, "All Units Responding to Box 989, switch to Handie - Talkie Channel 5."

In Brooklyn "All Units Responding to Box 1607, switch to Handie - Talkie Channel 6."

In addition, the Chief's Aide will contact each unit that arrived prior to the Chief and inform them of the necessary channel change. He may accomplish this by brief messages using Channel 1, or by personal contact.

8.4.3 Primary Command

This channel is restricted to use by Chief Officers at an expanding operation. As an operation progresses from 7-5 to second alarm and greater, the large number of sets on the tactical channel cannot be effectively controlled by the Chief in Command of the fire. Use of this channel will permit coordinated supervision of operations and present the fire commander with an effective span of control.

Guidelines for use of this channel are:

A. It will generally be placed in use when a Staff Officer takes command of an operation, and he shall so advise all his subordinate Chiefs. Depending on the scope of an operation, a Deputy Chief in Command could find its use advantageous and could order its use.

B. Whenever this Command Channel is placed in use, all Chief Officers subordinate to the Chief in Charge must have their Aides with them.

Each subordinate Chief's duties shall entail:

1. Operation on the Command Channel.
2. Evaluate all messages received from units under his area of command.

3. Transmit progress reports to the Chief in Charge when requested, or when necessitated by a changing situation.

His Aide's duties shall entail:

4. Operate on the Tactical Channel in use, establishing contact with all units under his Chief's area of control.

5. Receipt of messages and transmittal of orders from his Chief with all units in this area of control.

C. The Chief in Charge of an operation utilizing the Command Channel shall also have his aide or other qualified member in close proximity. The aide will usually:

a) Monitor the Tactical Channel in use for possible emergency transmissions.

b) Provide a back up radio in case of malfunction of the H.T. in use by the Chief in Command.

D. It is to be noted that the Primary Command Channels listed are the same as those for Secondary Tactical in certain Battalions. These Battalions are marked by an asterisk (below), indicating that only three channels are available. In the event that the Secondary Tactical is already in use, Primary Command shall then resort to the channel indicated within parentheses. This situation would develop where there are two nearby incidents, one of which develops to the Command stage. In this regard, preference of channel selection must always be given to Secondary Tactical, since its transmissions are more numerous. For example: if a fire has developed to the Primary Command stage, and a subsequent nearby incident occurs, the latter must be given the Secondary Tactical channel. Primary Command would have to switch to the channel in parentheses. This naturally presupposes that the second incident was of a relatively major nature, requiring a separate channel, as outlined under "Secondary Tactical".

Secondary Command

This channel is intended for use by Chief Officers requiring a Command Channel when the Primary Command Channel is already in use. Use of the Secondary Command would be required when a second major incident develops in close proximity to a major incident already in progress. Directions for its use shall be the same as those itemized under the "Primary Command Channel". Situations where more than three channels will be needed will of course be infrequent. As can be seen, if Secondary Command is required in an area where only three channels are available, the two Command frequencies will be sharing the same channel. Since command situation transmissions are few (less handie - talkies are involved), the likelihood of interference is limited.

Administrative Battalion District	Primary Tactical	Secondary Tactical	Primary Command	Secondary Command
		MANHATTAN		
* 1 thru 9	F1	F6	F6(F2)	F2
10	F1	F6	F5	F2
11 thru 16	F1	F5	F5	F2
		BRONX		
* 3,14,	F1	F5	F5(F2)	F2
15,17,18,19,26,27	F1	F5	F3	F2
,				
20	F1	F5	F4	F2
		STATEN ISLAND		
All	F1	F4	F3	F2
		QUEENS		
* 45,49	F1	F6	F6(F2)	F2
46,47	F1	F6	F4	F2
50,51,54	F1	F4	F6	F2
* 52,53	F1	F4	F4(F2)	F2
		BROOKLYN		
28,37,39,40				
41,44,48,58	F1	F6	F4	F2
33,43	F1	F4	F6	F2
42	F1	F4	F3	F2
57	F1	F6	F3	F2
*31,32,35,38	F1	F6	F6(F2)	F2

* These Battalions have just three channels available for use.

9. BATTERY CHARGING INSTRUCTIONS:

9.1 Battery charging time is critically different from the old HT - 220 radios. Because the current drain of the MX is more than that of the HT - 220, they must be charged more frequently. The capacity of this new battery is about eight hours for the MX - 330 radio as compared to 14 hours of the HT - 220 for a 5-5-90 duty cycle (5% transmit, 5% receive, 90% standby with power on). Failure to keep the battery charged will result in poor transmissions. The battery should be charged approximately every eight hours, therefore, all assigned Handie - Talkies shall be charged at the beginning of each tour or as soon as practicable thereafter and immediately after being exchanged at a Division Depot.

9.2 The Motorola single unit charger is a rapid charge system (one hour) designed to function with the battery remaining in the radio, or the battery may be removed and charged separately in the same charger.

9.2.1 Operation: Connect Charger to AC 105-125 volt power supply.

9.2.1.A To charge battery when attached to the MX radio:
Remove radio from leather case and place entire radio in charger so that battery contacts mate with metal fingers in battery charger pocket. Make sure contacts on rear bottom of radio battery are clean and make good contact with metal fingers in charger. Make sure radio is firmly seated.

9.2.2.B To charge battery when not attached to the MX radio:
Turn radio off.
Hold the radio in the left hand and press battery release (on side just above battery) with left thumb.
While holding the release depressed, rotate battery counter clockwise. Rotate battery about 180 degrees until CAM lock is clear and remove battery from radio.
To replace battery, reverse the procedure , first engage the CAM lock, then rotate the battery clock-wise until it latches in the proper position.

9.2.5 Battery charging lamps:

a. Red light indicates when battery or HT with battery is being charged.

b. Green light indicates when rapid battery charge cycle is complete.

c. Battery may be removed from charger before green light goes on, although the battery may not be fully charged.

d. Remove set when charged to a point that it shows green.

9.3 Precautions:

9.3.1. Make sure the lamps are glowing, otherwise the battery is not being charged.

9.3.2 A fully discharged battery is rapid charged in one hour and then automatically reduced to a ten hour trickle rate.

9.3.3 No attempt shall be made to charge batteries other than those supplied by the Department for use on the HT assigned to your unit.

9.3.4 If a battery gets too hot to hold it indicates trouble. Send it to the Department's Radio Repair Operations Unit for testing. A fully charged battery showing green should be warm when removed from charger, but a battery too hot to hold is defective.

9.3.5 If a battery is removed from a charger indicating green and then replaced it will read red for a short time. This is not good practice.

9.3.6 Battery shall not be overcharged. They shall be removed from charger when the green light goes on.

9.4 Batteries

9.4.1 The batteries used in the HT MX 330 VHF are designed for approximately 8 hours use before requiring recharging. However, fully charged batteries at the start of operations at a fire or emergency are a must for effective 2 - way communications.

9.4.2 In the event the HT MX 330 VHF charge cycle requires more than 1 1/2 hours, that is, the red light on the battery charger remains on in excess of 1 1/2 hours, the following procedure shall be followed.

a. Try charging another HT MX 330 VHF. If the charge is completed within 1 1/2 hours the battery in the first set is to be replaced. If the charge is not complete after 1 1/2 hours, the charger is probably defective. In this event, the charger is to be replaced.

b. Replacements of chargers can be made on a one-for-one exchange basis with a unit's division radio depot. For this purpose, each division will be issued spare battery chargers. HT MX 330 VHF with defective batteries shall exchange the entire radio at the radio depot. The entire unit will then be picked up by Radio Repair Operation's Radio Messenger.

c. Divisions' Radio Depots are to return defective chargers and HT MX 330 VHF radios with defective batteries to Radio Repair Operations via the Radio messenger.

10. SPECIAL FEATURES

10.1 The stuck-button problem occurs when a transmitter is inadvertently on all the time completely disrupting Handie - Talkie radio communications. **The HT MX 330 VHF has a time-out-timer which cuts off the transmitter after 30 seconds of continuous operations.** This is followed by a tone burst indicating that the transmitter has been shut off. The operator can key up the transmitter again if a longer conversation is required. The time-out-timer is a definite improvement since it corrects a problem which in the past has caused a breakdown in Handie - Talkie radio communications at fire and /or emergency operations.

10.2 Better voice quality as compared to the old HT-220 model.

10.3 Modular construction enabling more rapid repair at Radio Repair Operations by replacing plug-in modules instead of having to de-solder defective components and then solder in new components.

10.4 An indication when the battery is weak. The radio has a red light on top of the set. This indicates that the transmitter is on. **When the battery charge is low this light will be dim or off. The battery should then be charged or replaced.**

10.5 This radio does not have an external squelch control. However, on releasing the microphone switch a squelch burst is heard similar to the squelch noise in the old HT-220 radio.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT

Appendix L

AUC 19 OFFICE OF EMERGENCY MANAGEMENT

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AUC #19 Office of Emergency Management
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MAYOR'S OFFICE OF EMERGENCY MANAGEMENT (OEM)

1. INTRODUCTION

The city of New York must be prepared for and be able to coordinate rapid and effective responses to a wide range of emergency situations. Emergency management requires inter-agency and inter-governmental coordination as well as communication with the public and the press. The performance of these functions by the City is best coordinated by the Office of the Mayor. The Mayor's Office of Emergency Management has been established for this purpose.

2 DIRECTOR OF OEM

2.1 OEM shall be headed by a Director who shall be appointed by and serve at the pleasure of the Mayor. The Director shall report to the Mayor. The Director also shall serve as the local Director of Civil Defense, with the powers of a local Director of Civil Defense under L. 1951, Ch 784, as amended.

3 FUNCTIONS

3.1 Commencing April 1, 1996, OEM shall perform the following functions:

3.1.1 Coordinate the City's response to all emergency conditions and potential incidents which require a multi-agency response, including. but not limited to severe weather, threats from natural hazards and natural disasters, power and other public service outages, labor unrest other than the keeping of the peace, water main breaks, transportation and transit incidents, hazardous substance discharges, building collapses, and acts of terrorism.

3.1.2 Monitor all potential emergency conditions and potential incidents which may require a multi- agency response.

3.1.3 Coordinate and implement training programs, including emergency response drills, to prepare for emergency conditions and potential incidents which may require a multi-agency response.

3.1.4 Prepare plans for responding to emergency conditions and potential incidents, including but not limited to plans for the implementation of such emergency orders as may be approved by the mayor to protect public safety and facilitate the rapid response of City agencies and resources.

3.1.5 Make recommendations to the mayor concerning the City's emergency response capabilities and concerning the City's capacity to address potential emergency conditions and potential incidents.

3.1.6 Increase public awareness as to the appropriate responses by members of the public to emergency conditions and potential incidents, and review the City's systems for disseminating information to the public.

3.1.7 Operate and emergency operations center to assist the City in managing emergency conditions and potential incidents which may require a multi-agency response.

3.1.8 Hold regular and frequent meetings of designated emergency response personnel of all City agencies that are determined by the OEM director to have a direct or support role in the City's management of emergency conditions and potential incidents which may require a multi-agency response.

3.1.9 Assist City agencies in obtaining federal and other funding for emergency management and civil defense.

3.1.10 Coordinate with the Police Department to ensure that the City agencies develop and implement emergency response plans in connection with planning for major City events.

3.11 Coordinate with state, federal and other governmental bodies to effectuate the purposes of OEM.

3.1.12 Coordinate the operation of the local emergency planning committee, established pursuant to the Superfund Amendments and Reauthorization Act, Title III.

3.13 Coordinate New York City's Civil Defense effort in accordance with the provisions of the Defense Emergency Act of New York State and the City's Civil Defense Emergency Operations Plan, as such plan may be amended from time to time.

3.1.14 Carry out or delegate to other City departments responsibility for all civil defense functions mandated by the Defense Emergency Act of New York State.

3.15 Perform all other functions previously performed by the former Office of Emergency Management and the Emergency Control Board.

3.16 Perform such other duties as may be directed by the Mayor.

4 AGENCY COOPERATION

4.1 All agencies shall cooperate with the OEM in all respects in the implementation of this Order and the transfer to OEM of emergency management functions by April 1, 1996, and further shall provide OEM promptly with all information relevant to the performance of the emergency management functions set forth in the Order, and to collect and make available any data or other information requested by OEM for use in emergency planning. All agencies further shall provide OEM with all appropriate material and equipment currently used for the emergency management functions that are being assumed by OEM pursuant to this AUC.

BY ORDER OF THE FIRE COMMISSIONER AND THE CHIEF OF DEPARTMENT