

Comparative Analysis for the Decentralization of the Milwaukee Fire Department Bureau  
of Special Operations utilizing the Fire Department City of New York Squad Company  
Concept

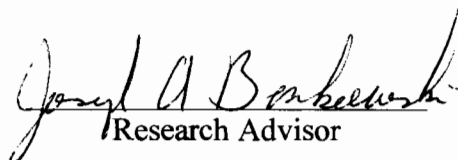
by

Erich Joseph Roden

A Research Paper

Submitted in Partial Fulfillment of the  
Requirement for the  
Master of Science Degree in  
Training and Development

Approved for Completion of 4 Semester Credits  
TRHRD-735 Field Problem in Training and Development

  
Research Advisor

The Graduate School  
University of Wisconsin-Stout  
January, 2005

The Graduate School  
 University of Wisconsin-Stout  
 Menomonie, WI 54751

ABSTRACT

Roden (Writer)(Last Name)	Erich (First Name)	J. (Middle Initial)
Comparative Analysis for the Decentralization of the Milwaukee Fire Department Bureau of Special Operations Utilizing the Fire Department City of New York Squad Company Concept.		
(Title)		
M.S. Training and Development, (Graduate Program)	Dr. Joseph Benkowski (Research Advisor)	January 2005 119 (Month/Year) (# of Pages)
American Psychological Association, 5 <sup>th</sup> edition (Name of Style Manual Used in this Study)		

The study was conducted to determine if the Fire Department, City of New York (FDNY) Squad Company concept provides for an acceptable decentralization strategy for the Milwaukee Fire Department's (MFD) Bureau of Special Operations. The contemporary fire service is faced with new challenges in addition to historical, conventional response requirements. Furthermore, it is incumbent upon the MFD, in particular the Bureau of Special Operations to develop a deployment model to meet these challenges. The MFD Bureau of Special Operations has not decentralized its specialized capabilities under the present construct of its three special teams: the Hazardous Materials Team, Heavy Urban Rescue Team, and Dive Rescue Team. As a result,

insufficient response(s) to multiple or simultaneous incidents and inefficient utilization of special team personnel and resources has occurred.

A comparative analysis was performed using the FDNY's Special Operations Command and the MFD's Bureau of Special Operations' response capabilities and deployment methods. The findings of the study indicate that the FDNY Squad Company Concept provides for the most efficient and effective use of the MFD's existing resources to meet contemporary and future challenges. The nation's fire service is now regarded as America's "First Responders" to any threat facing a municipality's socioeconomic vitality and health; and the MFD can accept this designation by providing the most effective response possible to those it is sworn to protect.

## Acknowledgements

The author would like to dedicate this study to the following individuals:

*Deputy Chief Ray Downey, FDNY*

Deputy Chief Ray Downey was instrumental in warning the nation's fire service as to the threats facing municipalities and the need to plan and organize response to meet them. Chief Downey was also instrumental in designing the FDNY's Squad Companies in response to these threats and in their successful incorporation into the Special Operations Command. Tragically, Chief Downey was killed on September 11, 2001 operating side by side with members of his Special Operations Command during the greatest rescue attempt in the nation's history.

*Lieutenant Andrew Fredericks, FDNY*

Lieutenant Andrew Fredericks was assigned to Squad Company 18 in lower Manhattan and was one of the fire service's most prolific authors and speakers. Lieutenant Fredericks was operating high inside the World Trade Center on September 11, 2001 when he was lost during the ensuing collapse. His influence and inspiration will never be forgotten as will his dedication to keep Firefighters safe through his teachings.

The author would also like to thank the following for their assistance, support, and guidance throughout the study:

*Dr. Joseph Benkowski*

Professor at the University of Wisconsin-Stout and the author's advisor for his guidance in the research and development of this study and his dedication to the field of Training and Development.

*Dan Rode*

A Firefighter with the City of Milwaukee assigned to Ladder Company 2 and friend for his guidance and help in discovering and identifying the problem(s) studied in this paper; and his assistance throughout the study.

*John Grasso*

A Lieutenant with the FDNY and the author's teaching partner at the Fire Department Instructors Conference for his guidance, experience, friendship, and support of the study. John survived the collapse of the World Trade Center on September 11, 2001 and faithfully and tirelessly searched for our fallen brothers.

*Mark Owen*

The author's former Officer and Captain of Engine Company 28; for his help and extensive experience in the field of Hazardous Materials and Domestic Preparedness. Captain Owen is now serving as the Captain of Interagency Coordination between the Milwaukee Fire Department, Milwaukee Police Department, and City of Milwaukee. Captain Owen's dedication with regards to Domestic Preparedness will undoubtedly prepare the City of Milwaukee and State of Wisconsin, respectively, to meet contemporary and future threats.

*Heather Roden*

The author's spouse for her unwavering support during the course of this study. Her support and encouragement will never be forgotten as will her patience during the author's course of study.

*Colleen Roden*

The author's daughter, for bringing forth the realization that nothing is as important as the family that supports your every ambition and goal; and for her patience during hours spent in front of the computer during the course of the study.

## TABLE OF CONTENTS

ABSTRACT.....	ii
Chapter I: Introduction.....	1
<i>Statement of the Problem</i> .....	5
<i>Objectives of the Study</i> .....	5
<i>Significance of the Study</i> .....	7
<i>Limitations of the Study</i> .....	7
<i>Assumption of the Study</i> .....	8
<i>Definition of Terms</i> .....	9
Chapter II: Review of the Literature.....	13
Chapter III: Methodology.....	60
<i>Instrumentation</i> .....	60
<i>Data Collection</i> .....	60
<i>Data Analysis</i> .....	61
<i>Limitations</i> .....	62
Chapter IV: Results.....	63
<i>Introduction</i> .....	63
<i>Item Analysis</i> .....	70

<i>Comparative Results</i> .....	85
Chapter V: Discussion.....	86
<i>Limitations</i> .....	92
<i>Recommendations</i> .....	94
<i>Summary</i> .....	107
References.....	108

## Chapter I:

### Introduction

Protecting the City of Milwaukee's socioeconomic vitality and health invariably befalls its first responders. First responders are defined in the Homeland Security Act of 2002, as: Those individuals who in the early stages of an incident are responsible for the protection of life, property, evidence, and the environment. Relative to this definition and regardless of the posed threat, emergency, or disaster, the City of Milwaukee's principle first responder tasked with mitigating the consequences of their occurrence becomes the Milwaukee Fire Department (MFD). This designation is acceptingly relayed by the MFD in its current mission statement:

The mission of the Milwaukee Fire Department is to protect people and property within the city. The department responds to the needs of citizens by providing rapid, professional, and humanitarian services essential to the health, safety, and well-being of city residents (Milwaukee Fire Department [MFD], 2004).

In adherence to this mission statement, the MFD must submit to these demands by exercising the foresight to meet future threats as well as hindsight to face those already anticipated.

Historically tasked with suppressing the incidence of uncontrolled fire, the MFD's contemporary obligation is that of responding to virtually every emergency, threat, and disaster; thus evolving the MFD into its current structure. The MFD at present consists of six Battalions comprising of thirty-six Engine Houses quartering thirty-seven Engine Companies and Sixteen Ladder Companies. Moreover, three of these Engine Houses have added responsibilities associated with their respective special team designations

(MFD, 2004). The Hazardous Materials team quartered at Engine 25 responds to accidental and malicious release of hazardous chemicals and products. Engine 3 quarters the Dive Rescue team and responds to all water-related emergencies in the City of Milwaukee's numerous waterways. The Heavy Urban Rescue Team (HURT) responds to incidents involving structural collapse, confined spaces, high and low angle rope rescues, and other technically complex emergencies; and is quartered at Engine 12. These incident types fall outside the scope of conventional fire suppression and due to their respective complexities, require further administrative governance under the MFD's Bureau of Special Operations.

The Bureau of Special Operations results from the recent consolidation of two previous, mutually exclusive Bureaus, the Bureau of Emergency Medical Services (EMS) and the Bureau of Special Teams. With approximately 80% of the MFD's request for service now EMS related, the Bureau of EMS was charged with administering pre-hospital medicine provided by the MFD in both Basic Life Support (BLS) and Advanced Life Support (ALS) capacities. Furthermore, the decentralization of EMS through the MFD's thirty-seven Engine and sixteen Ladder Companies was accomplished under the auspices of this Bureau. The Bureau of Special Teams was organized to administer the response of the three aforementioned special teams due to their similar logistical and statutory requirements.

However, after the subsequent investigation into the fire service's role during the attacks on September 11, 2001, the MFD starkly realized the similar and arduous demands on both of these Bureaus, and their necessitated, complimentary co-existence during major disasters and emergencies. Henceforth, the Bureau of Special Operations

was established thereby creating a collective entity exclusively tasked with preparing for and responding to practically all emergencies that categorically fall outside the scope of conventional fire suppression within the MFD.

The Bureau of Special Operations does assume a significant responsibility at the scene of major structure fires however. The introduction of rapid intervention into the MFD as a means of rescuing trapped, incapacitated, lost, or disoriented Firefighters follows a nation wide trend to prevent the second and third leading causes of Firefighter death, trauma and asphyxiation respectively. When a structure fire in the City of Milwaukee is upgraded to a third alarm or greater, the HURT team assumes the role of a Rapid Intervention Team (RIT). Rapid intervention routinely entails complex rescues and specialized equipment due to the fact that the occurrence of Firefighter death and injury is commonly the result of entrapment; due to structural damage and or collapse. Therefore, the Bureau of Special Operations understandably becomes the most capable to affect and deploy this response (United States Fire Administration [USFA], 2003).

Perhaps the most significant role, however, that the Bureau of Special Operations is contemporarily charged with concerns the greatest threat to the nation and City of Milwaukee, respectively; terrorism. Although the nation in the last decade has witnessed the reprehensible devastation of terrorism on the nation's soil and infrastructure on several occasions, it becomes the events of September 11, 2001 that have placed the role of the fire service at the forefront of this threat. The evident and experiential threats and hazards posed by terrorism and its associated Weapons of Mass Destruction (WMD) include: Nuclear, biological, and chemical (NBC) release, structural collapse(s), and resulting mass casualties. These consequences of terrorism customarily befall the Bureau

of Special Operations and the capabilities of its current special teams. As a result of these consequences, these response demands necessitate that the MFD's Bureau of Special Operations adequately deploy its resources to meet its domestic preparedness requirements in addition to its other requisite contemporary and conventional responses.

In addition to various special team apparatus relative to the individual teams, all special team Engine Houses quarter an Engine Company that responds in a conventional role regarding fire suppression and EMS. In addition, Engine 12 quarters a Ladder Company as well that also responds in similar conventional manner; and is regarded as a "Double House." When dispatched to fire and or EMS related alarms, members assigned to these Engine Houses respond via their quartered Engine and or Ladder Company; and render the special team apparatus un-staffed and unavailable until these members return to quarters.

Staffing of each respective special team Engine House consists exclusively of those members of the particular team quartered there. Each special team also maintains a roster of additional team members who are assigned to various Engine Houses throughout the City of Milwaukee and are available to respond to escalating incidents. These members are assigned to conventional Fire Companies throughout the City of Milwaukee and do not possess their special team capabilities while responding with said Companies. Deployment of these personnel in their special team capacity to an escalating incident is haphazard at best as transportation and staffing dilemmas often lead to delays in their arrival at an incident. Furthermore, this delay often accounts for varying quantities of available personnel throughout the duration of an escalating incident. Subsequently, deploying these members to multiple and or simultaneous incidents requiring the

response of the Bureau of Special Operation's special teams is similarly and problematically delayed; and does not compliment the MFD's mission of affecting rapid response.

#### *Statement of Problem*

The MFD has successfully decentralized its conventional fire suppression and EMS capabilities through its thirty seven Engine Companies and sixteen Ladder Companies; including those quartered in special team Engine Houses. However, the special teams component of MFD's Bureau of Special Operations has concurrently failed to decentralize its relative, specialized capabilities; and will thereby encompass the concentration of the study. Historical, documented attempts at decentralization of early, limited rescue capabilities were discovered but later transcended into the contemporary EMS treatment and transport that is currently provided by the Bureau of Special Operation's Fire Squads (Nailen and Haight, 1971). The previously decentralized, limited specialized rescue capabilities consequently regressed into the current centralized construct of the three special teams. The resulting outcome related to said lack of decentralization of the contemporary special teams since their respective dates of inception is causal for the inadequate and inefficient utilization of existing Bureau of Special Operation's resources to affect specialized rescues and responses; particularly regarding its apparatus and personnel.

#### *Objectives of the Study*

The purpose of this study is to provide the MFD's Bureau of Special Operations, specifically its special teams deployment, with an effective means of decentralization of its capabilities. The researcher selected to study the Fire Department of New York's

(FDNY) Squad Company concept due to operational successes with this particular model in decentralizing its similarly tasked Special Operations Command (SOC). The inclusion of the Squad Company concept into the FDNY's SOC involved the use of its existing resources, namely its conventional Engine Companies to affect decentralization. The MFD did attempt to decentralize early specialized rescue capabilities and utilized conventional Engine Companies in a manner to affect this by equipping them as "Auxiliary Rescue Squads." However, as stated above, this early decentralization later progressed in contemporary EMS delivery rather than a mode of specialized rescue decentralization. Relative to the contemporary FDNY's successful redeployment of its existing resources to decentralize its contemporary SOC capabilities, and the successful early decentralization of specialized capabilities in the MFD's historical context, the objectives of the study are to:

- 1) Determine if the utilization of currently deployed conventional Engine Companies provides an effective apparatus to decentralize the MFD's Bureau of Special Operation's special team capabilities, including mass decontamination and responses to multiple and or simultaneous incidents.
- 2) Determine if the FDNY Squad Company concept provides for the optimum means of utilizing special teams personnel; particularly those team members not currently assigned to a special team Engine House.
- 3) Compare existing MFD Bureau of Special Operations and FDNY SOC utilization and response protocols and establish a response and staffing model for the MFD's deployment of Squad Companies.

- 4) Determine if Squad Company utilization by the MFD would meet established national response standards relative to its requisite and anticipated capabilities.

#### *Significance of Study*

The utilization of the MFD's Bureau of Special Operation's existing resources, apparatus, and personnel, to decentralize its response capabilities provides for a reasonable alternative that does not significantly burden the current fiscal constraints facing the City of Milwaukee and MFD, respectively. Furthermore, The MFD has acquired grant money through various domestic preparedness benefactors that includes the purchase and subsequent delivery of three mass decontamination trailers. The MFD currently has no strategy in place to deploy these trailers into the MFD's response. Deploying these trailers with Squad Companies trained in mass decontamination, an existing capability of the MFD's Hazardous Materials team, would allow for their adequate integration into the MFD's domestic preparedness response capability; principally due to an Engine Company's available water source.

In accepting its designated role as the City of Milwaukee's principal first responder, the MFD must prepare for future and anticipated threats. The FDNY Squad Company concept not only affords the MFD this capability with regards to domestic preparedness and associated hazards of related disasters, but on the fireground as well, specifically with its developing rapid intervention capabilities.

#### *Limitations of the Study*

The MFD has researched the FDNY's Rescue Company concept with regards to increasing the Bureau of Special Operation's current centralized capabilities. Although this concept would satisfy the Hazardous Materials team's State of Wisconsin obligatory

regional response requirement, it does not solve the incumbent inadequacies regarding the centralization of its capabilities. The Squad Company concept presents a feasible method of decentralizing the Bureau of Special Operation's capabilities in co-existence with the establishment of centralized Rescue Companies and could possibly resolve said inadequacies. The success of the FDNY's decentralization of its SOC capabilities utilizing Squad Companies has complimented its pre-existing, operational Rescue Companies and Hazardous Materials Company. Therefore, the study will be limited to the FDNY Squad Company concept exclusively, and its possible incorporation into the MFD's response.

*Assumption of the Study*

It will be assumed that during the course of the study that the FDNY will not change or alter the deployment or response capabilities of its Squad Companies. A similar assumption is made that the MFD's Bureau of Special Operations will not attempt any strategy or model of decentralization. The researcher will comparatively determine the compatibility of the FDNY Squad Company concept to that of the MFD's Bureau of Special Operation's response capabilities and provide recommendations for its implementation within the MFD.

## Definition of Terms

*Authority Having Jurisdiction:* The organization, office, or individual responsible for approving equipment, an installation, or a procedure (NFPA, 1997).

*Battalion:* A geographic division of the Milwaukee Fire Department under the command and administration of a Battalion Chief. There are six Battalions in the Milwaukee Fire Department, each consisting of five to six Engine Houses (MFD, 2004).

*Biological Weapons:* Infectious agents or toxins which are pathogenic to man (MEMA, 2004).

*Blister Agent:* A chemical agent also called a vesicant, which causes severe blistering and burns to the eyes, skin, and respiratory tract (MEMA, 2004).

*Blood Agent:* A chemical agent that interferes with the ability of blood to transport oxygen and causes asphyxiation (MEMA, 2004).

*Chemical Agent:* A chemical substance which is intended for use in military operations to kill, seriously injure, or incapacitate personnel through its physiological effects (MEMA, 2004).

*Chemical Protective Clothing:* Items made from chemical resistive materials, such as clothing, hood, boots, and gloves, which are designed and configured to protect the wearer's torso, head, arms, legs, hands, and feet from hazardous materials (NFPA, 1997).

*Choking Agent:* Cause damage to the tissues of the respiratory system and the eyes (MEMA, 2004).

*Cold Zone:* The control zone of a hazardous materials incident that contains the command post and such other support functions that are deemed necessary to control the incident.

This zone is also referred to as the clean or support zone (NFPA, 1997).

*Contamination:* The process of transferring a hazardous material from its source to people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure (NFPA, 1997).

*Critical Infrastructure:* Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters (DHS, 2003).

*Decontamination:* The physical or chemical process of reducing and preventing the spread of contaminants from persons and equipment used at a hazardous materials incident (NFPA, 1997).

*Double Engine House:* An Engine House quartering both an Engine and Ladder Company (MFD, 2004).

*Emergency Operations Center:* A site from which civil government officials exercise direction and control in an emergency or disaster (MEMA, 2004).

*Engine Company:* Engine Companies carry personnel, hose, water, and various firefighting equipment. Fire Engines are mobile pumping equipment. Each vehicle has an internally mounted pump (MFD, 2004).

*Engine House:* Also known as a firehouse in the Milwaukee Fire Department. Engine Houses quarter Engine and Ladder Companies as well as other support apparatus. There are generally 5-6 Engine Houses per Battalion. In the MFD, Engine Houses number 36 (MFD, 2004).

*First Responder:* Refers to those individuals who in the early stages of an incident are responsible for the protection and preservation of life, property, evidence, and the environment (Homeland Security Act, 2002).

*Hazardous Material:* A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property (NFPA, 1997).

*Hot Zone:* The control zone immediately surrounding a hazardous materials incident, which extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as the exclusion zone or the restricted zone (NFPA, 1997).

*Incident Commander:* the person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site (NFPA, 1997).

*Ladder Company:* The chief function of a ladder company is to provide a large assortment of tools and appliances needed at fires and the manpower to use these tools (MFD, 2004).

*Life Saving Squad:* Principle function is the administration of first aid and basic life support to victims of accident or sudden illness (MFD, 2004).

*Monitoring Equipment:* Instruments and devices used to identify and quantify contaminants (NFPA, 1997).

*Nerve Agent:* A substance that interferes with the central nervous system (MEMA, 2004).

*Personal Protective Equipment:* The equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that can be encountered at a hazardous materials or fire suppression incident. Personal protective equipment includes both personal protective clothing and respiratory protection (NFPA, 1997).

*Self-Contained Breathing Apparatus:* Protective equipment consisting of an enclosed face piece and an independent, individual supply of air; used for breathing in atmospheres containing toxic substances (Buck, 2002).

*Single Engine House:* An Engine House that quarters an Engine Company only (MFD, 2004).

*Terrorism:* The unlawful use of force against persons or property to intimidate or coerce a government, the civilian population or any segment thereof, in the furtherance of political or social objectives (MEMA, 2004).

*Turnout Gear:* Also called bunker gear or structural firefighting protective clothing, the protective clothing normally worn by firefighters during structural firefighting operations. It includes a helmet, coat, pants, boots, gloves, PASS device, and hood (NFPA, 1997).

*Warm Zone:* The control zone at a hazardous materials incident where personnel and equipment, decontamination, and hot zone support takes place. It includes control points for the decontamination corridor, thus helping to reduce to the spread of contamination. This zone is also referred to as the decontamination zone or limited access zone (NFPA, 1997).

*Weapons of Mass Destruction:* In arms control usage, weapons that are capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people; can be nuclear, chemical, biological, and radiological weapons (MEMA, 2004).

## Chapter II:

### Review of the Literature

#### *A Historical Perspective*

The most insidious threat to the City of Milwaukee proper at the time the MFD was organized as a paid fire department on January 1, 1875, was the incidence of uncontrolled fire. The results of uncontrolled fire were obvious to Milwaukee's then 72,000 residents and demanded a rapid response by the MFD to adequately protect the city. To meet this criterion, the MFD simply relied on a decentralized, nation-wide fire service deployment trend of its available resources, five Engine Companies, one Ladder Company, and twenty-six horses (also referred to as Fire Companies), thereby quartering them in strategically and geographically located Engine Houses. This ensured encompassment of all areas of the City of Milwaukee in its realm of response, with simply the addition of more Engine Houses and Fire Companies as unprotected areas were annexed (Nailen and Haight, 1971).

As the population of the City of Milwaukee tripled between 1870 and 1890, the demands on the MFD increased as well due to a booming economy, technology, and infrastructure to support the city's perpetual growth. The formulation of the contemporary MFD began at the turn of the next century as its role in the City began to perpetually change as well. Historically tasked with fire suppression, the MFD's rapid response capability befit the request of it to respond to virtually every emergency and disaster affecting the city's socioeconomic vitality and health. The MFD, again paralleling trends in the nation's fire service, was now being requested for incidents such as building collapses, automobile and industrial accidents, and water and tunnel

emergencies, in addition to its conventional fire suppression duty. The introduction and addition of EMS in the latter half of the century, along with hazardous materials, confined space, and other technically complex emergency responses to the MFD's repertoire of capabilities, necessitated the formulation of specialized teams to provide these capabilities (Nailen and Haight, 1971).

Perhaps the origin of the MFD's development of its specialized teams can historically be traced back to a successful rescue that is deemed extremely heroic even by today's standards. On April 30, 1906, during the construction of a utility tunnel under the Milwaukee River to compliment the City of Milwaukee's growing infrastructure, a tunnel laborer was trapped when a supporting wall failed; thereby flooding the tunnel. Faced with the prospect of the laborer drowning in the tunnel, other tunnel workers who luckily escaped requested the MFD to respond in an attempt save their trapped comrade. Warned of certain death by attempting to rescue the trapped laborer, members of the MFD's Fireboat 29 and Truck 1 selflessly and unwaveringly entered the tunnel. Wading through rising flood water, these members painstakingly attempted to forcibly enter an airlock door against the weight of the encroaching water to reach the laborer. Entry was accomplished after several harrowing and arduous minutes and the laborer was rescued, seconds away from certain death. As a result of this daring rescue, the laborer survived and those involved in the rescue received the famed and renown Carnegie Medal Award; the only such awarding of this medal in MFD history (Nailen and Haight, 1971).

This dramatic rescue initiated a renewed focus on the MFD's capabilities to respond to these and other emergencies that were initially deemed outside its conventional role. As the MFD continued to increase its conventional fire suppression

capabilities as a result of several major disasters and successful rescues, it also began acquiring equipment to affect rescues and response to a perpetually growing list of emergencies it would encounter. In 1917, breathing respirators were purchased to facilitate operations in gas leaks and oxygen deficient atmospheres. The use of these respirators allowed the MFD to affect rescues that were in earlier contexts never attempted. Successful results and incorporation of these respirators into all facets of the MFD's response paralleled their use by the nation's fire service and have successively evolved into the current Self Contained Breathing Apparatus (SCBA) worn by contemporary fire departments (Nailen and Haight, 1971).

The purchase of early oxygen inhalators in 1918, crudely known as "lung motors," allowed the MFD to begin resuscitation of civilians at fires and other emergencies; and due to their apparent success and numerous requests during emergencies led to the creation of a "Rescue Squadron." This Rescue Squadron was organized to carry and deploy these new resuscitators as well as the previously incorporated breathing respirators. This allowed other Fire Companies to continue responding in their conventional roles without being tied up at emergencies requiring this specialized equipment. As the request for Rescue Squad capabilities increased in the following decade, their response was now experientially required on all downtown and greater fire alarms; and at all other emergencies outside the scope of conventional fire suppression and capabilities. Furthermore, their workload increased to the point that a second Rescue Squad was organized to decentralize this response component of the MFD and led to the creation of Rescue Squad 2. This permitted Rescue Squad response that

adequately covered the north and south sides of Milwaukee respectively (Nailen and Haight, 1971).

With the demands on the Rescue Squads increasing, it was inevitable that the equipment carried by these units increase as well. Asbestos suits, underwater lights, jacks, saws, etc., were just a small description of the equipment carried to perform a myriad of complex rescues. Later into the century, Rescue Squad response was overwhelmingly requested for incidents involving drownings, heart attacks, and gas leaks. Furthermore, it was realized that apparent problems existed in sending conventional, large Rescue Squad apparatus on these “less significant” incidents and were also costly at the time. As a result the Rescue Squad deployment further transcended into a more decentralized manner with the organization of the smaller apparatus equipped Squads 4 and 5 respectively; as well as the use of conventional Engine Companies as “Auxiliary Rescue Squads.” These Engine Companies carried and deployed the inhalators and led to their eventual deployment to that of contemporary BLS and ALS pre-hospital care (Nailen and Haight, 1971).

The Rescue Squads, now numbered at six in the latter half of the century, were finding their capabilities requested in more of a medical or EMS related fashion than in their intended response role regarding specialized rescues; and their deployment later progressed their development into “Life Saving Squads;” more aptly regarded as early ambulances. These Life Saving Squads, in addition to the multitude of rescue equipment stated above, also began carrying stretchers, splints, and other assorted patient treatment and packaging equipment. Their apparatus configurations also changed from re-constructed conventional fire apparatus to light vans with patient loading doors (Nailen

and Haight, 1971). The Life Saving Squads are still deployed today as Fire Squads utilizing conventional ambulances for EMS responses only and no longer carry or deploy specialized rescue equipment. Specialized rescue equipment comparable to early, historical Rescue Squad use and deployment is now carried and centralized by means of the HURT team exclusively.

In addition to early Rescue Squad deployment and use, the MFD was faced with numerous rescue requests for water-related emergencies in the City of Milwaukee's numerous waterways. The sheer complexity and dangers involved required the MFD to develop a specialized group of Firefighters trained in underwater rescue. The Rescue and Recovery Team, also known as the "SCUBA Team" was organized in 1961 and became the centralization model of the MFD's current deployment of its specialized response capabilities. Similarly in 1979, the Hazardous Materials Response Team was also organized as its own exclusive special team. In 1985, the Milwaukee Metropolitan Sewerage District (MMSD) embarked on a deep tunnel project that posed similar emergencies and hazards found during early City of Milwaukee tunnel system and infrastructure development. This project led to the creation of the Deep Tunnel Rescue Team and was also organized as an exclusive special team. The Deep Tunnel Rescue Team was therefore trained and equipped to respond to confined space, trench, and excavation rescues (Putchinski, 2003).

1990 saw the organization of the Technical Rope Rescue Team tasked with rescuing those trapped in low and high-angle emergencies, as well as structural collapses, and confined spaces. The duplication of the Deep Tunnel Rescue Team and Technical Rope Rescue Team's confined space response capabilities led to their subsequent

consolidation into the currently organized and deployed HURT team in 1995; again their capabilities remaining mutually exclusive to the other special teams. The conclusion of the decade also witnessed new, significant demands on these aforementioned teams in terms of their deployment requirements (Putchinski, 2003).

In 1996, the State of Wisconsin created a Hazardous Materials Regional Response Team Network in which the MFD's Hazardous Materials team was included and required to respond not only to hazardous materials incidents in the City of Milwaukee proper, but to the following counties: Milwaukee, Waukesha, Ozaukee, Washington, and northern portions of Jefferson counties (Putchinski, 2003). Response to hazardous materials incidents within these counties is assumed by the centrally quartered MFD Hazardous Materials team only and response to simultaneous and or multiple hazardous materials incidents occurring in the City of Milwaukee thus depends on those Hazardous Materials team members assigned to various Fire Companies throughout the City of Milwaukee.

#### *Rapid Intervention: A Primer*

The introduction of rapid intervention into the nation's fire service was rooted in the concurrent occurrence of the second and third leading causes of Firefighter death and injury; trauma and asphyxiation respectively. A recent 10 year (1991-2000) study of Firefighter death and injury from structural collapse by the United States Fire Administration reported that 56 Firefighters died as a result of structural collapse. The majority was operating either inside or on a structure and died as a result of complications related to internal trauma, crushing injuries, burns and asphyxiation. Further results of the study indicate that although the incidence of structural fires nationally is down, the rate of Firefighter death and injury has not paralleled this

decrease. Moreover, the rate of Firefighter death and injury per 100,000 incidents has actually increased and the probability of these death and injuries occurring per incident increases as well (USFA, 2003).

The objective of rapid intervention on the fireground is the assembly and deployment of a Rapid Intervention Team (RIT) in a staged holding pattern on the fireground available to rescue trapped, lost, injured, and or incapacitated Firefighters. Causal factors facing a RIT include but are certainly not limited to: Entanglement, floor collapse, confined space, and above and below ground rescues. Other contributing factors include advances in Firefighter protective clothing and SCBAs allowing deeper penetration into structures under extreme fire conditions; thereby increasing the operating times and potential of structural collapse; and the consequences associated with the lack of experience related to the decrease in fire duty (USFA, 2003). As stated above, these scenarios and the means to mitigate them befall the specialized capabilities of the HURT team. Initially during a structure fire, a Ladder Company is assigned the role of the RIT. However, coinciding with their respective ability to mitigate these complex emergencies, it was inevitable that the HURT team be deployed to escalating incidents with the potential for any of the above causal factors; hence their automatic response in this role to third alarm or greater fires.

#### *Rapid Intervention: Engine Company Support*

It is widely accepted by the nation's fire service that the first hoseline deployed at a fire is the greatest life saving tool on the fireground. The reason behind this assumption is that once the fire is extinguished, every subsequent operational task on the fireground can be accomplished in a safer, more effective manner; this is also relevant in a rapid

intervention context. Often, structural collapse occurs before or during the extinguishment of a fire and can render the initial hoseline(s) useless to aid in rescuing the resulting trapped Firefighters. Along with the MFD's deployment of a Ladder Company and the HURT team as RIT, an Engine Company should also be assigned in a RIT support role. Utilization of Engine Companies in a RIT capacity will allow for the deployment of protective fire streams to aid in Firefighter rescue. Several examples requiring the protection of a hoseline to affect a Firefighter rescue have been documented (Fredericks, 1999).

During the 23<sup>rd</sup> Street collapse in New York City on October 17, 1966 where 12 Firefighters perished, the use of protective fire streams to drive back the encroaching fire was the only effective measure employed that enabled the FDNY to reach their fallen comrades; In 1997 during a commercial fire in Detroit, Michigan, two firefighters were killed as a result of a fire wall collapse and another was killed after a fall from a third floor window escaping the ensuing fire. A fourth Firefighter became trapped at another third floor window by impinging fire and an astute Engine Company Firefighter at the street kept the fire at bay with a deck gun until a ladder could be placed to rescue him; perhaps the most dramatic example occurred during the 1993 World Trade Center (WTC) bombing. Firefighter Kevin Shea from FDNY Rescue 1 fell into the crater created by the explosion resulting in serious injuries. As fire was encroaching on his position, Firefighter Shea utilized his portable radio to direct fire streams to his position by the sound of their impact adjacent to him. The protection of these fire streams enabled the FNDY to eventually reach his position and rescue him (Fredericks, 1999).

The FDNY incorporates protective fire streams into its RIT capabilities by deploying a Rapid Intervention Company-Engine (RICE) to structure fires in addition to their principle RIT, a Ladder Company. This combination allows for the staging of forcible entry tools, saws, ropes, and related extrication equipment in conjunction with hoselines, nozzles, and large caliber stream (LCS) devices. The late FDNY Lieutenant Andrew Fredericks, described the importance of incorporating a RICE into rapid intervention response by stating that “when rapid fire spread or collapse occurs, the prompt application of water may be the only means of saving trapped Firefighters and protecting members of the RIT/FAST during rescue and removal efforts (Fredericks, 1999).”

#### *Rapid Intervention: A Proactive Approach*

The USFA describes in its 2003 publication, “Rapid Intervention Teams and How to Avoid Needing Them,” a proactive approach that could be employed by larger city Fire Departments with “adequate” staffing levels. This approach entails utilizing a larger RIT and detailing several members of the RIT to secure secondary means of egress from the structure by creating and or procuring multiple entry and exit points. Enlarging window and door openings, removal of window bars and gates, and breaching walls affords a greater safety margin in the event a RIT response is necessary.

#### *Terrorism: Defined*

The United States Department of Justice (DOJ) defines terrorism as “the unlawful force against persons or property to intimidate or coerce a government, the civilian population, or segment thereof, in the furtherance of political or social objectives.” Simply stated, the fundamental goal of terrorism is to instill fear to cause a change in

politics or social issues through the use of intimidation. There are five commonly accepted variables in understanding the guiding principles of terrorism:

- 1) Violence need only be threatened. Adding to this threat is the fear that the government, whether municipal, State, or Federal, is unable or unwilling to adequately provide protection from terrorist acts or their associated hazards;
- 2) Fear is the actual agent of change. The goal of terrorism is to relay a threat in anticipation of a fearful response from those who can affect change in social or political climates;
- 3) Terrorist's victims are not necessarily the ultimate targets. Victims of terrorist acts are often considered "pawns" in terrorists' attempts at instilling fear in those observing the act;
- 4) Those who observe the act are the intended targets. Terrorist acts often occur under the subsequent display of the media. It is this audience that is the intended, ultimate targets;
- 5) A terrorist's desired outcome is political or social change. The intended goal of terrorism is to instill fear and distrust of government. This includes both domestic and foreign terrorism. Religion, abortion, and public policy are just several of the topics on terrorist's agendas (Buck, 2002).

#### *Terrorism: Critical Infrastructure*

Critical Infrastructures are defined as: systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters. There are eleven categories

of critical infrastructures in the United States as defined by the Department of Homeland Security (DHS):

- 1) Agriculture and Food
- 2) Water
- 3) Public Health
- 4) Emergency Services
- 5) Defense Industrial Base
- 6) Telecommunications
- 7) Energy
- 8) Transportation
- 9) Banking and Finance
- 10) Chemical Industry and Hazardous Materials
- 11) Postal and Shipping (DHS, 2003).

With regards to the nature of terrorist attacks against critical infrastructures, it is in their long-term strategic objectives to attack these national and local assets and systems. According to the DHS, terrorists attack critical infrastructures to achieve three distinct objectives:

- 1) Direct infrastructure effects: Causing disruption or arrests of the functions of critical infrastructures through direct attacks on a critical node, system, or function;
- 2) Indirect infrastructure effects: Causing disruption or financial consequences for government, society, and economy through public and private reaction to attack;

- 3) Exploitation of infrastructure: Exploitation of elements of a particular infrastructure to disrupt or destroy another target (DHS, 2003).

The disastrous events of September 11, 2001 demonstrated the vulnerabilities to threats posed by terrorists using mass destruction terrorism against critical infrastructures. In response to these events, it is imperative that Federal, State, and most directly, local governments, adopt specific objectives aimed at protecting critical infrastructures. Objectives include: Identifying infrastructures that are deemed the most critical; providing timely warning and assuring protection of said infrastructures; and assuring the protection of infrastructures and assets that could be perceived as potential terrorist targets by pursuing initiatives that enable Federal, State, and local governments to better protect them (DHS, 2003).

#### *Terrorism: Weapons of Mass Destruction*

Weapons of Mass Destruction (WMD) are defined as weapons that are capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people. They can be nuclear, chemical, biological and or radiological weapons, but excludes the means of transporting or propelling the weapon where such means is a separable and divisible part of the weapon (Maryland Emergency Management Agency, 2004). Recent terrorist events have forced the nation's first line of defense, its first responders, to exclusively confront WMD incidents and their devastating effects. A chemical, biological, radiological, explosive, and or incendiary device used in a terrorist attack poses unprecedented challenges for the nation's first responders and requires adequate preparation and response (Office of Domestic Preparedness, 2002).

Preparation foremost begins with an understanding of the associated hazards and properties of WMD agents. Chemical weapons include any substance that is intended for use by terrorists to kill, seriously injure, or incapacitate humans through its toxicological effects (WMD First Responders, 2000). Commonly used chemical and nerve agents include: Hydrogen cyanide, Sarin (GB), Soman (GD), Mustard (H), Tabun (GA), and VX. Chemical agents are generally liquids, have varying effects, onset times range from seconds to minutes, and most are heavier than air, save hydrogen cyanide; Common routes of exposure are through the lungs, eyes, and skin (WMDFirstresponders.com, 2000). Chemical terrorism usually entails an overt attack because the routes of exposure and their effects are immediately obvious, as is often intended, and will invariably require the initial response of police, fire, and EMS, in other words, municipal first responders (Centers for Disease Control [CDC], 2000).

Biological weapons and their relative hazards and effects on the other hand may not present their dissemination immediately, particularly with a covert release. Often, unless stark indication of an attack is relayed by those responsible, passive recognition befalls those trained in their symptom recognition at the health care facility and surveillance level (National Association of County and City Health Officials [NACCHO], 2001). Biological weapons have etiological consequences and fall into three distinct categories based on their posed risk. Category A involves agents that pose threats to national security due to the fact that they can:

- 1) Easily be disseminated or transmitted person to person;
- 2) Cause high mortality, with potential for major public health impact;
- 3) Might cause public panic and social disruption;

- 4) Require special action for public preparedness.

Category “A” biological agents include: Smallpox, anthrax, plague, botulism, tularemia, ebola virus, and hemorrhagic fever (CDC, 2000).

Category “B” agents:

- 1) Are moderately easy to disseminate;
- 2) Cause moderate morbidity and low mortality;
- 3) Require specific enhancements of CDC’s disease surveillance

Category “B” biological agents include: Q-fever, brucellosis, glanders, alphaviruses, ricin, epsilon virus, staphylococcus enterotoxins, salmonella, and cryptosporidium (CDC, 2000).

Category “C” agents include agents engineered for mass dissemination in the future due to their:

- 1) Availability;
- 2) Ease of production and dissemination;
- 3) Potential for high morbidity and mortality

Category “C” biological agents include: Nipahvirus, hantavirus, tick-borne hemorrhagic fever, encephalitis, yellow fever, and multi-drug resistant tuberculosis (CDC, 2000).

“Dirty bombs” are perhaps the most desired and feared radiological weapons that terrorists seek to acquire. Radioactive materials contained in “dirty bombs” are widely used in hospitals, research facilities, industrial, and construction sites. Their uses range from diagnosing illnesses and sterilizing medical equipment to inspecting welding seams. Dissemination of a “dirty bomb” usually entails the utilization of a conventional explosive to disperse the radiation. The resultant explosion would inherently kill and

injure more people than the radiation itself that is used due to the fact that the most probable sources of radiation would not provide the amount needed for mass casualties. However, certain radioactive materials dispersed in air could contaminate several city blocks prompting extensive decontamination concerns and clean-up costs, as well as resultant and the intended mass panic and fear. Mitigating the impact of a “dirty bomb” depends on the prompt detection of the type of radioactive material used to enable responding agencies to employ the proper evacuation and decontamination methods of those affected (United States Nuclear Regulatory Commission [NRC], 2003).

Extensive contamination of critical facilities and large geographic areas may result from the release of chemical, biological, and radiological weapons. Victims may unknowingly transport contaminants to businesses, residences, public assembly venues, and health care facilities. Unless first responders prepare and affect self-awareness of this possibility, the potential for them to cross-contaminate others as well also exists unless trained in decontamination principles and methods; and this statement will be validated in the following text (Federal Emergency Management Agency [FEMA], 2001).

According to the U.S. Army Soldier and Biological Chemical Command (SBCCOM) in its January 2000 report “Guidelines for Mass Casualty Decontamination during a Terrorist Chemical Agent Incident,” page 4, for first responders, there are three purposes of decontamination:

- 1) Remove the agent from the victims’ skin and clothing, thereby reducing possible agent exposure and further effects among victims;
- 2) Protect emergency responders and medical personnel from secondary transfer exposures (cross-contamination);

- 3) Provide victims with psychological comfort at, or near, the incident site, so as to prevent them from spreading contamination over greater areas.

Cross-contamination is of vital concern as its potential for further devastation and panic was documented during the Sarin gas attack on the Japanese subway system. 5,510 victims sought medical attention at 278 different hospitals and medical clinics. Of these victims, 12 subsequently died from exposure with 17 of them considered critically ill, 37 seriously ill, and 984 moderately ill. 4000 of the 5,510 victims were found to not have any exposure to the Sarin gas yet still sought treatment. To provide first responders and health care facilities with a perspective of the probable types and range of victims, the SBCCOM suggests anticipating at least a 5:1 ratio of victims to actual casualties as a guideline. In other words, for every casualty that is actually exposed to an agent, more than five who are not will be evaluated (SBCCOM, 2000).

The SBCCOM (2000, pg. 4), further states that the most important action undertaken during decontamination is the rapid physical removal of the agent from those who are contaminated. Physical removal of agent can occur by: Scraping, blotting, disrobing, absorbing, and flushing or showering patients with large quantities of water. The latter is a method that is easily employed by Firefighters due to the fact that they usually respond to every incident with large quantities of water to bear; and it is considered an effective decontamination agent. The flushing or showering of patients requires however, that Engine Company apparatus(s) are available on scene specifically for this contingency (SBCCOM, 2000).

As stated above, decontamination by removal of clothes in addition to flushing and or showering, is the most expedient and practical method for first responders to

accomplish. Moreover, the wetting down of victims while disrobing speeds up the decontamination process further. A method of accomplishing this effective means of decontamination is described by the SBCCOM as the Ladder Pipe Decontamination System (LPDS). Construction of this system utilizes equipment abundantly available to Fire Departments. This equipment includes: Ladder pipes, monitors, and fog nozzles attached to Engine and Ladder Company apparatus strategically arranged to construct a decontamination corridor. The resulting corridor allows for the flushing of numerous ambulatory casualties from numerous directions (above and horizontally) at once to affect the removal of contaminants. Redundant LPDS can be deployed for non-ambulatory casualties as well (SBCCOM, 2000).

First responders, particularly Firefighters responsible for decontamination, must also concern themselves with prioritizing resulting casualties for decontamination. The method of decontamination prioritization is synonymous to that of medical triage involving numerous patients and both can be performed simultaneously. Dividing prioritization into two categories, ambulatory and non-ambulatory provides the most expedient and successful manner of decontamination (SBCCOM, 2000).

Factors regarding the priority of decontaminating ambulatory casualties involve:

- 1) Casualties located closest to the point of release
- 2) Casualties reporting exposure to vapor or aerosol release
- 3) Casualties with evidence of deposition on clothing or skin
- 4) Casualties with serious medical symptoms
- 5) Casualties with conventional injuries

Ambulatory victims should be decontaminated based on their order of importance based on the above considerations. Factors concerning non-ambulatory casualties include the use of the Simple Triage and Rapid Transport (START) method during decontamination prioritization due the complexity involved with rescuing those who are unconscious, injured, or deceased. This again involves utilizing medical triage practices to determine who will be decontaminated first and successively. Administration of medical reagents to combat the effects of exposure may also have to be performed in the hazard area (hot zone) and requires individuals specifically trained in hazardous materials response to perform these procedures as it may be the only effective means of procuring victim(s) survival. As a result of operating within the contaminated area to rescue both ambulatory and non-ambulatory casualties, and the potential of cross-contamination during all aspects of decontamination, it is imperative that first responders prepare for the hazards of operating in said area; and their own decontamination as well (SBCCOM, 2000).

Initially, responding Firefighters will don personal protective equipment (PPE) (bunker gear) and SCBA for a potential chemical, radiological, or biological agent incident. With regards to initial rescue needs during a chemical agent attack, said Firefighters would possibly attempt a rescue under the following conditions:

- 1) The type and extent of the chemical hazard is determined based on an immediate assessment of the scene that includes discernable victim signs and symptoms;
- 2) Entry using turnout gear, also known as “bunker gear” and SCBA is only a consideration, if the initial responders do not have chemical agent detectors or certified chemical protective clothing immediately available;

- 3) Firefighters will only enter potentially contaminated areas to perform rescue of “known live victims” or to perform an immediate reconnaissance to determine the evidence of chemical contamination and cannot identify any living victims;
- 4) Firefighters will avoid contact with any unidentified liquids;
- 5) Firefighters and rescued victims will undergo emergency decontamination immediately upon exit from the potentially hazardous area;
- 6) Immediate medical assistance such as that provided by EMS providers is immediately available on scene (SBCCOM, 2003).

Relative to the above considerations, when Firefighters equipped with PPE and SCBA attempt to affect a rapid rescue or situational reconnaissance, they are subjected to greater risks associated with chemical exposure than that of Firefighters equipped with certified chemical protective equipment. In other words, it is always recommended to wear chemical protective equipment rather than Firefighter PPE and SCBA when operating in these environments. However, unless responding Firefighters are: aware of, trained in, and equipped for, a chemical, radiological, and or biological incident or attack, several consequences will result from operating exclusively in Firefighter PPE and SCBA (SBCCOM, 2003). For instance, the SBCCOM in its 2003 report “Risk Assessment of Using Firefighter Protective Ensemble with Self-Contained Breathing Apparatus for Rescue Operations during a Terrorist Chemical Attack” (pg. 7), describes three examples of operating in nerve and mustard agent’s realistic maximum concentrations respectively.

In the first two examples, the associative risks with wearing PPE and SCBA in chemical nerve agent attacks were assessed at two specific applied concentrations for

each nerve agent. The first concentration surrounds a ten-minute exposure time that several victims are purported to survive. This exposure is assumed to affect victims before responders arrive on the scene and is further dubbed the Maximum Survivable Concentration (MSC). Moreover, during this ten-minute exposure, two percent of the exposed victims are expected to survive from nerve agent exposure. The documented example for a GB nerve agent gives a MSC of 5 mg/m<sup>3</sup>. The second applied concentration refers to that assumed to be present at a terrorist attack involving nerve agents. This concentration is a realistic concentration, or reasonably maximum concentration; and for a GB nerve agent is 2000 mg/m (SBCCOM, 2003).

Using the aforementioned concentrations for GB as an example, and with respect to the lower concentrations involved with the MSC, the smallest exposure time for all nerve agent MSC's is 30 minutes at 5 mg/m<sup>3</sup>. Conversely, the smallest exposure time for all nerve agents at the reasonable or realistic maximum concentration is only three minutes at 2000 mg/m<sup>3</sup>. With a documented threshold effect dose of 1200 mg-min/m<sup>3</sup> (at this dose, 50 % of exposed individual will experience sweating and muscle weakness 1-18 hours after exposure), two operational situations were given based on the following two exposure concentrations:

- 1) Operating for up to 30 minutes inside of a potentially contaminated area to perform rescue of a "known live victims" in the MSC for agent GB, or 5 mg/m<sup>3</sup>;
- 2) Performing a 3-minute reconnaissance inside of a potentially contaminated area to "identify if live victims exist" in a GB agent concentration of 2000 mg-min/m<sup>3</sup> (SBCCOM, 2003).

In other words, the first situation gives the anticipated dosage a Firefighter will receive while performing rescue operations for 30 minutes. The result of the study indicated that a Firefighter in PPE and SCBA will receive a dose of 15 mg-min/3. This is far below the documented threshold effect dose of 1200 mg-min/m<sup>3</sup> and would allow for a rapid rescue, however, operating unknowingly in this environment or for extended periods increases the chance for exposure and nerve agent effects. The latter situation describes the dosage a Firefighter may be exposed to while operating in an area containing high concentrations of GB nerve agent. Firefighters operating in this environment would receive a dosage of 571 mg-min/m<sup>3</sup> after three minutes. Again this falls below the 1200 mg-min/m<sup>3</sup> threshold and would place responding Firefighters in PPE and SCBA in danger if exposure time is increased due to being unaware of operating in such an environment; Moreover, three minutes is the critical timeframe to recon the suspected area in order to determine the amount of, if any, viable victims (SBCCOM, 2003).

The SBCCOM further describes another scenario involving mustard agents (H series). The difference between nerve and mustard agents with regards to Firefighter exposure is that mustard agents provide no reliably immediate reactions in victims. Effects may not present themselves for hours after dissemination of a mustard agent and awareness relies on Firefighters ability to identify and discern the signs of this agent's release. The realistic maximum concentration of mustard agent that is anticipated during a terrorist release is 300 mg/m<sup>3</sup>. With this concentration, the maximum exposure time for a Firefighter in PPE and SCBA is only one-minute. Using this concentration, 50% of Firefighters exposed would experience irritation and reddening of sensitive body regions

to these effects such as: ears, neck, armpits, and groin. These exposures' effects are analogous to a Firefighter receiving first degree burns over approximately 4% of his body, yet in said regions deemed sensitive to these effects. Consequences of unknowingly operating in a mustard agent release or environment for nine minutes (200 mg-min/m<sup>3</sup>) would result in the Firefighter receiving blisters and burns of second degree severity in these sensitive body regions (SBCCOM, 2003).

Operational considerations based on the above dose/rate responses necessitate that the following operational considerations be measured in addition to those described in the determination of the possibility of a rescue attempt:

- 1) The presence of living victims inside the potential hazard area provides the basic indicator for firefighters to assess the level of contamination for nerve agents;
- 2) Rescue entry occurs after vapor concentration has peaked (ten-minutes after agent release);
- 3) Firefighters using PPE and SCBA to perform rescue of known live victims can operate for 30 minutes with "minimal" risks associated with MSC's for nerve agent exposure;
- 4) Using PPE and SCBA to perform said rescue where concentrations are at the MSC may result in sweating and muscle weakness in exposed Firefighters 1-18 hours after exposure;
- 5) Exposure time in an unknown environment without live victims should be limited to three minutes while in PPE and SCBA;

- 6) Firefighters searching enclosed areas should immediately exit the area and be decontaminated if no live victims are encountered;
- 7) If signs of a mustard agent are encountered, Firefighters should immediately exit the area and be decontaminated (SBCCOM, 2003).

There are several recommended awareness guidelines set forth for Firefighters regarding WMD by the Office of Domestic Preparedness (ODP) in its 2002 document "Emergency Responder Guidelines" (pg. 4-6):

- 1) Recognize hazardous materials incidents;
- 2) Know protocols used to detect the potential presence of WMD agents or materials;
- 3) Know and follow self-protection measures for WMD events and hazardous materials events;
- 4) Know procedures for protecting a potential crime scene. Whether or not a witness to the event;
- 5) Know and follow agency/organization's scene security and control procedures for WMD and hazardous materials events;
- 6) Possess and know how to properly use equipment to contact dispatcher or higher authorities to report information collected at the scene and to request additional assistance or emergency response personnel;

In addition to the numerous guidelines and considerations stated in the above text, there are relative, applicable, nationally recognized standards which impact the role and duties of the MFD's Bureau of Special Operations. These standards are set forth by both the Federal Government and the National Fire Protection Association (NFPA), a

nationally recognized fire service standards development organization. NFPA standards are established by committees consisting of subject matter experts in the relative field of the standard and are subject to public comment prior to publication. NFPA standards are not mandatory, yet many states adopt their language into their own statutory requirements. The following standards apply to the current MFD Bureau of Special Operation's specialized capabilities.

*NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*

NFPA 1710 is a recently adopted standard set forth in an attempt to standardize career fire departments' responses to virtually all facets of fire suppression, EMS, and special operations. With regards to the special operations components of the standard, it specifically requires that fire departments describe the criteria for various types of special operations responses and mitigation in their respective organizational statements. Included in this statement are special operations that are required and or expected by the respective communities served by said fire departments. Likewise, this also refers to the criteria set for the various types of response during incidents involving natural disasters, terrorist attacks and WMD incidents, and mass casualty events (National Fire Protection Association [NFPA], 2001).

As Per the NFPA 1710 standard, special operations include the following response types: water rescue, extrication, hazardous materials, confined space entry, and high-angle rescue. All of these special operations response types are current capabilities of the MFD's Bureau of Special Operations. Firefighters expected to respond to

hazardous materials incidents beyond the scope of the hazardous materials operations level must meet the applicable requirements of NFPA 471 and 472, respectively. Conversely, responses to confined space incidents beyond the confined space operations level must be performed by Firefighters meeting the requirements of NFPA 1670 and 1006, respectively. Furthermore, the NFPA 1710 standard addresses the establishment of a RIT team to both fires and special operations incidents. The establishment of a RIT team on the fireground is required for the purpose of rescuing lost or trapped firefighters; the role and utilization of the RIT team at special operations incidents is to provide support to responding Firefighters in the event of equipment failure or other sudden, unanticipated events (NFPA, 2001).

*NFPA 471: Recommended Practices for Responding to Hazardous Materials Incidents*

Upon arrival at a hazardous materials incident, WMD chemical, biological, and radiological agents inclusive, it is necessary for first responders, the MFD exclusively, to configure and implement three control zones: the hot, warm, and cold zones. The hot zone is operationally referred to as an exclusion or restricted zone that provides for a virtual barrier surrounding the assumed site of the release or dissemination. The hot zone must extend far enough to prevent adverse health effects from the released product to affect others operating in the warm and cold zones. The warm zone provides the area in which decontamination, contamination reduction, and support of those operating in the hot zone occurs. The warm zone is also known as the area containing the decontamination corridor. The cold zone implies the area in which the incident commander and other support functions, equipment, and personnel operate; also known as the clean zone (NFPA, 1997).

Operating in the hot zone requires the utilization of specialized metering and detection equipment to aid in determining the type and amount of release, as well as the perimeters of the three control zones. The following examples of this type of equipment include, but are certainly not limited to:

- 1) Oxygen meters
- 2) Combustible gas indicator
- 3) Carbon Monoxide (CO) meter
- 4) pH meter
- 5) Radiological detection instruments
- 6) Colorimetric detector tubes
- 7) Organic vapor analyzer
- 8) Photo ionization meter
- 9) Air sampling devices
- 10) pH paper

Respirators used and required during operations in the hot and warm zone include SCBA and Powered Air Purifying Respirators (PAPR) and must meet applicable NFPA and OSHA standards. In addition to the requisite metering and respiratory protection, an assortment of chemical protective clothing (CPC) is used during the mitigation of chemical and WMD agent releases and the determination for their use depends on the type of said release (NFPA, 1997).

CPC are made from specialized materials intended to protect the wearer from the hazards posed by the chemical and or agent he is operating in. There are two types of CPC, totally encapsulating and non-encapsulating. The determination of which type to

incorporate into mitigation is further divided into four levels of protection, levels: A,B,C, and D. Level A CPC is used when greatest level of skin, respiratory, and eye protection is warranted based on the hazard posed by the specific chemical and or agent. This includes the use of totally encapsulating protective clothing that covers the wearers' torso, head, and extremities, as well as the wearer's hard hat, gloves, boots, and two-way radio communications. Disposable suits, gloves, and boots may be worn over the totally encapsulating protective suit (NFPA, 1997).

Level B should be worn when the highest level of respiratory protection (SCBA) is needed, yet a lower level of skin protection is required. This includes utilizing hooded, non-encapsulating CPC that includes the above required hard hat, gloves, boots, and two-way radio communications. Level C CPC is used when the concentration and amount of airborne substance is known and does not warrant the level or respiratory protection necessitated with the use of level A or B CPC. PAPR's may be used with level C CPC along with a hooded, non-encapsulating CPC and requisite hard hat, gloves, and two-way radio communications. Level D is the lowest level of protection afforded and is warranted for "nuisance contamination" only. This includes work uniforms consisting of: coveralls, boots, gloves, hard hat, and safety glasses. Other CPC is available for those incidents requiring thermal protection as well that includes proximity and fire entry suits; not to be confused with conventional fire suppression PPE (NFPA, 1997).

To further determine which level of CPC is required for a given release, NFPA 471 (1997, page 9) provides several types of hazards for making such determinations. Level A protection should be used when any of the following conditions are present:

- 1) When the hazard requires the highest level of skin, respiratory, and eye protection from a high concentration of vapors, gases, or particulates; and when the incident poses the threat of splash, immersion, or unanticipated exposure to the above concentrations;
- 2) When it is known or suspected that the chemical or agent poses a threat to the skin; and skin contact is possible;
- 3) When the operational environment is atmospherically unknown and or requires entry into inadequately ventilated and confined areas.

Level B CPC should be worn in the following circumstances:

- 1) When the concentration of the substance is known and requires the greatest level of respiratory protection; yet the risk to the skin is less significant;
- 2) When the atmosphere contains less than 19.5% oxygen in air;
- 3) When liquids and particulates are indicated, yet do not pose a threat to the skin via contact or absorption.

Level C CPC is warranted with the following conditions:

- 1) When the atmospheric and environmental contaminants including liquid splashes will not pose risk to exposed skin;
- 2) When the use of a PAPR will successfully and adequately prevent contaminants from the entering the wearers' respiratory system due to the concentrations of the chemical or agents being known and or identified;
- 3) When the oxygen concentration in air is at least 19.5% and no IDLH concentrations exist for the known contaminants.

Level D CPC can be worn in the following situations only:

- 1) The atmosphere contains no known hazards;
- 2) When the work performed poses no risk of splashes, immersion, or exposure to airborne contaminants.

There are two basic methods of mitigating the release of hazardous materials; they include both physical and chemical controls. Both methods of mitigation must be performed by those with the proper training, education, and experience only. Physically mitigating a hazardous materials release consists of reducing the spill, leak, or the release mechanism, and can be accomplished by the following: Absorption, covering, dikes, dams, diversions, dilution, over pack, plug and patching, transfer, vapor suppression, vacuuming, and venting. Chemical mitigation includes: Adsorption, burning, dispersion, emulsification, gelatin, neutralization, polymerization, and solidification (NFPA, 1997).

As stated in the above text, it is necessary for first responders to prepare not only for the decontamination of affected victims, but themselves as well. Paralleling the two methods of mitigation, decontamination is also performed using either physical or chemical means. Per NFPA 471 (1997, page 12), decontamination must be in place before entering the hot zone, unless a possible rescue presents itself in accordance with emergency decontamination if available; whichever decontamination method is used is based upon the inherent hazards posed by the chemical or agent.

During a terrorist attack and resulting WMD agent release, as well as any hazardous material incident, first responders may actually respond to said attack under the assumption that it is a conventional response to another alarm type. As a result, this places the responders in a contaminated atmosphere without their knowledge and initial responders are frequently operating in the hot zone before the hazardous product is

identified and decontamination is even considered. If it comes to the attention of the first responders that they are indeed operating in a contaminated environment, they must immediately leave the area and corral at a single location to be decontaminated without cross-contaminating other responders, equipment, and apparatus. If any released hazardous material is known or any magnitude of a terrorist attack is suspected, decontamination procedures must be in place with the proper number of personnel and stations prior to commencing operations; and must continue during the entire incident duration or until the Incident Commander decides it is no longer needed (NFPA, 1997).

Physical decontamination methods include the following: Absorption, brushing and scraping, isolation and disposal, vacuuming, and washing. Chemical methods of decontamination include: Adsorption, chemical degradation, disinfection or sterilization, neutralization, and solidification. Decontamination methods will vary in their effectiveness given the particular chemical or agent, however, three criteria should be considered in aiding in this determination:

- 1) Contamination levels should be reduced as those being decontaminated move through the decontamination corridor;
- 2) Contamination should be confined to the hot and warm zones (decontamination corridor) only;
- 3) Contamination should be reduced to the lowest achievable level possible.

Determining the effectiveness of decontamination during the above criteria can be furthermore accomplished and assisted via the following methods:

- 1) Visual observations including stains, discolorations, and effects of corrosive chemicals or agents;

- 2) Monitoring or metering equipment;
- 3) Wipe sampling.

Personnel affecting decontamination should also be operating with the appropriate level of CPC and requires that they are adequately and similarly trained and experienced as those operating in the hot zone (NFPA 471).

*NFPA 472: Standard for Professional Competence of Responders to Hazardous  
Materials Incidents*

The MFD's Hazardous Materials Team maintains a requirement that its members be trained to at least the Hazardous Materials Technical Level. The competencies for this training is outlined in NFPA 472 and emphasizes the recommended practices for responding to hazardous materials incidents set forth in NFPA 471. The Hazardous Materials Technician is principally tasked with analyzing a hazardous materials incident to determine the incident magnitude and type by surveying the incident to identify the involved containers and materials; including the concentrations of hazardous materials present through the aid of monitoring equipment. Among this requirement is the prediction of the anticipated behavior of the released material(s) and estimate of the size of the incident area(s) utilizing computer modeling and monitoring equipment (NFPA, 1997).

Perhaps the most challenging requirement set forth in NFPA 472 is the competency regarding the ability to plan a response within the capabilities of available personnel, PPE, and mitigation control equipment (physical and chemical). This competency thereby requires the Hazardous Materials Technician to possess the ability to:

- 1) Identify the response objectives;
- 2) Identify potential action options available by response objective;
- 3) Select the appropriate level of PPE for given action option;
- 4) Select the appropriate decontamination procedures (physical or chemical);
- 5) Develop a plan of action.

Implementation of the planned response to significantly and successfully change the outcome of the incident is the goal of the Hazardous Materials Technician; including evaluation of the progress of the response and its operational effectiveness; as well as successfully terminating the incident; including assisting in debriefing and critique (NFPA, 1997).

*NFPA 1670: Standard on Operations and Training for Technical Search and Rescue Incidents*

The purpose of NFPA 1670 is to provide guidance to an authority having jurisdiction (AHJ), namely the MFD for the purpose of this study, in an assessment of technical search and rescue hazards within the City of Milwaukee. Moreover, identification of the MFD's level of operational capability is paramount to the standard as is establishing operational criteria. The standard describes three operational levels: Awareness, operations, and technician. For the purposes of this study, the standards relating to the technical level will be described in the following text as it is the level currently applied by the MFD Bureau of Special Operation's HURT and Dive Rescue Teams (NFPA, 2004).

As stated above, performing a hazard identification and risk assessment is necessitated to determine the feasibility of the AHJ (MFD) to conduct technical search

and rescue operations based on the results. Per section 4.2.2 of NFPA 1670 (2004), the premise of the hazard and risk assessment is to identify and evaluate environmental, physical, social, and cultural factors influencing the scope, frequency, and magnitude of a potential technical search and rescue incident; and their impact on the MFD's ability to respond and operate while minimizing threats to the rescuers. Specifically, the MFD shall identify the type and availability of internal resources needed for technical search and rescue incidents. Moreover, the MFD shall also that said resources commensurate with its respective capabilities to operate at these incidents are provided. Personal Protective Equipment must also be provided to all those operating at technical search and rescue incidents, including those who may potentially become exposed to the hazards posed by the incident type (NFPA, 2004).

NFPA 1670 addresses the MFD's requisite ability to determine if response to a particular incident poses the risk or chance of involving nuclear or biological weapons, WMD, and chemical agents. Moreover, anticipation for secondary devices aimed at detrimentally delaying or negating effective technical search and rescue must be also be considered as part of a response's hazard and risk assessment. Section 5 of NFPA 1670 (2004) lists the general requirements for operations at the technical level at structural collapses:

- 1) Recognizing hazards, using equipment, and implementing appropriate techniques for incidents involving all construction types;
- 2) Evaluation of existing and potential conditions at structural collapse incidents;
- 3) Recognizing unique collapse or failure hazards;
- 4) Accessing victims trapped inside and beneath collapse debris;

- 5) Performing extrication operations involving packaging, treating, and removing victims trapped within and beneath collapse debris;
- 6) Stabilizing the structure.

Chapter 6 of NFPA 1670 (2004), lists the technician level requirements for rope rescue incidents:

- 1) Evaluation of existing and potential conditions at incidents where rope rescues will be performed;
- 2) Understanding of physics involved in constructing rope rescue systems, including system safety factors, critical angles, and cause and effects of force multipliers within rope rescue systems;
- 3) Negotiating obstacles while ascending and descending a fixed rope commensurate with the organization's needs;
- 4) Constructing multiple-point, load-distributing anchor systems commensurate with the organization's needs;
- 5) Constructing an elevated point to facilitate safe transition of rescuers or victims over difficult edges;
- 6) Selecting, constructing, and using a high-line rope system commensurate with the organization's needs;
- 7) Utilizing a high-line rope system to transport rescuers, equipment, and an occupied litter commensurate with the organization's needs;
- 8) Utilizing litter attendants within a high-line rope system.

Chapter 7 of NFPA 1670 (2004), lists the technical level requirements for operations at confined space emergencies:

- 1) Evaluating existing and potential conditions at confined space emergencies;
- 2) Ensuring that rescue team members take part in a medical surveillance program;
- 3) Planning response for entry-type confined space rescues in hazardous environments;
- 4) Implementing the planned response.

Chapter 9 of NFPA 1670 (2004), lists the technical level capabilities for water search and rescue:

- 1) Evaluation of existing and potential conditions at incidents where water search and rescue will be performed;
- 2) Planning a response within the capabilities of available resources;
- 3) Implementing a planned response consistent with the organization's capabilities;
- 4) Conducting boat-assisted and boat-based rescues;
- 5) Conducting a "go" rescue;
- 6) Application of physics and physiology as it relates to the underwater environment;
- 7) Use of dive tables;
- 8) Dealing with the various underwater environments with which the rescue diver could come into contact;
- 9) Avoiding and dealing with underwater plants and animals;
- 10) Conducting and supervising dive operations;
- 11) Using accepted search techniques;
- 12) Recognition and management of near-drowning in cold water;
- 13) Utilizing redundant and alternate air sources during low or out-of-air emergencies

- 14) Utilizing full-body encapsulation equipment, including dry suits, dry hoods, and dry gloves with full-face mask in contaminated water;
- 15) Rescuing an entangled diver;
- 16) Medical monitoring of divers;
- 17) Recovering evidence including locating, securing, and packaging evidence;
- 18) Reach, throw, go rescue technique unique to ice rescue;
- 19) Use of watercraft, specialty craft, and specialty equipment unique to ice rescue;
- 20) Organizations operating at the technician level at swift water rescue incidents shall develop and implement procedures for applying rope rescue techniques in the swift water environment.

Chapter 11 of NFPA 1670 (2004), lists the requirements for operating trench and excavation search and rescue incidents at the technician level:

- 1) Evaluation of existing and potential conditions at trench and excavation emergencies;
- 2) Identifying, constructing, and removing manufactured protective systems consistent with the application and limitations of such systems using tabulated data and approved engineering practices;
- 3) Continuously, or at frequent intervals, monitoring the atmosphere in all parts of the trench to be entered for oxygen content, flammability, and toxicity, in that order;
- 4) Identifying the construction, application, limitations, and removal of supplemental sheeting and shoring systems designed to create approved protective systems;

- 5) Adjusting the protective systems based on digging operations and environmental conditions;
- 6) Rigging and placement of isolation systems.

*NFPA 1006: Standard for Rescue Technician Professional Qualifications*

NFPA 1006 sets forth the minimum job performance requirements to meet certification as a Rescue Technician. This standard identifies the specific criteria and requisite skills relative to the above NFPA 1670 technician level requirements for operating at technical search and rescue incidents. Certification as a Rescue Technician per NFPA 1006 requires meeting all requisite skills and knowledge in Chapter 5 of the standard: Job Performance Requirements; and all of the respective knowledge and skill requirements of at least one of proceeding chapters (Chapter 6-14). Chapters 6-14 of NFPA 1006 consist of the specific requirements for operating at the aforementioned: structural collapses, rope rescues, confined space, water search and rescue, and trench and excavation emergencies (NFPA, 2003).

Chapter 5, of NFPA 1006, and the specific job performance requirements, becomes the principle component of the standard. Chapter 5 comprises of the requirements set forth for site operations, victim management, maintenance, and ropes and rigging. Managing the incident site requires that the Rescue Technician possess sound ability to identify the needed support resources and logistical needs. The ability to size-up an incident to determine the number and last known location(s) of victims, and validity of available information to develop an incident action plan is an integral part of the chapter. Management and identification of incident hazards to ensure the risk to rescuers and victims is minimized is essential and includes the use and dissemination of

applicable reference material. Conducting a search for victims using hazard-specific PPE is accomplished through proper incident size-up and can only be accomplished if the above criteria are met to ensure safe entry into any incident hazard. The final component associated with managing the incident site is the capability to successfully terminate the incident and make certain that all rescuers are accounted for and removed from the scene to return to operational readiness (NFPA, 2003).

Once site operations criteria is in place, proper size-up of inherent hazards is accomplished, and search operations successfully reach a victim(s), management of said victim(s) is necessary. Assessing a victim for the scope of injury(s) requires knowledge and skills in providing emergency medical care and stabilization. Chapter 5 relays the need to provide basic first aid that includes management of the victims' airway, control of major bleeding, spinal immobilization, and treatment of shock. Triage of victims may be necessary if a mass casualty scenario exists and requires sound practice in rapid determination of the severity of injuries and priority of rescue. Utilizing special equipment to move and transport the victim is a paramount element to NFPA 1006 as it requires a firm understanding of ropes and rigging practices in patient packing and removal to be effective (NFPA, 2003).

Knowledge and skills in tying knots, bends, and hitches with ropes and webbing to construct anchor, mechanical advantage, lowering, and belay systems, are the technical components of chapter 5 of NFPA 1006; and the ability to maintain said systems is another paramount component of the standard. Maintenance of PPE, rope, and rigging equipment is necessary to ensure operational readiness and to prevent or become aware of potential damage placing rescuers at risk. Completion of logs, records, or other record-

keeping systems allows for timely notification and replacement of equipment and aids in selection of proper equipment for a given hazard or incident type. Specific knowledge, skills, and abilities required to meet the objectives in chapter 5 and other parts of the standard are referenced in the appendices of NFPA 1006 regarding certification as a Rescue Technician. (NFPA, 2003).

*Domestic Preparedness:*

*National Incident Management System*

On February 28, 2003, the Homeland Security Presidential Directive (HSPD)-5 instructed the Secretary of Homeland Security to develop and administer a National Incident Management System (NIMS). Following the events of September 11, 2001, improving responder's prevention, preparedness, response, recovery, and mitigation capabilities regarding: terrorism, fires, hazardous materials spills, nuclear and aircraft accidents, and natural or man-made disasters was needed on both a local and national level. Due to many municipal, State, and Federal agencies potentially responding to the above incidents, a comprehensive approach to managing these incidents would streamline multi-jurisdictional response and provide for timely and adequate sharing and dissemination of information. Moreover, the adoption of NIMS by Federal, State, and local governments is so crucial to the assurance of Homeland Security that it is now a Federal mandate in order to receive Federal funding for local domestic preparedness initiatives (DHS, 2004).

Most incidents require response on the local level to mitigate their consequences of occurrence. However, there exists, as history has demonstrated, incidents that initially require response from a single jurisdiction yet perpetuates into a multiple response with

many jurisdictions and response capabilities needed, particularly with contemporary hazards and threats. The National Incident Management System (NIMS) provides for modular, expandable framework for these multiple jurisdictions to operate together, or more widely known as, multi-jurisdictional interoperability (DHS, 2004).

The basic premise of NIMS is the utilization of the Incident Command System (ICS), a command and control system currently employed by the nation's fire service. The ICS is based on three key operational systems: The components of ICS itself, multi-agency coordination systems, and public information systems. The ICS as it relates to NIMS relies on effective and efficient domestic incident management by the integration of facilities, equipment, personnel, procedures, and communications within a singular organizational structure. As stated above, most incidents require a single-jurisdictional response; however, management of expanding incidents is a fundamental concept of NIMS. In particular, biological, chemical, and radiological incidents pose a significant challenge to the conventional ICS structure used by the fire service; especially those geographically dispersed over a wide area and not site specific. The massive coordination of Federal, State, and municipal organizations with respect to expanding incidents is the principal focus of NIMS (DHS, 2004).

The ICS structure formulates a top-down, modular system that allows for expansions paralleling that of the incident's logistical and resource requirements. The structure places one individual in command with multi-jurisdictional authority to expand an incident based on its complexity or inherent hazards; and is referred to as the Incident Commander (IC). Designation of an IC is the responsibility of the primary jurisdictional authority over the incident. As the incident expands in complexity, the organization of

ICS parallels this expansion from the top down and establishes functional responsibilities that are delegated by the IC. Conversely, as the incident recedes in complexity, so does the organization of the ICS (DHS, 2004).

The functional management principle used in ICS is management by objectives.

With regards to the objectives on page 10 of NIMS (DHS, 2004), this includes:

- 1) Establishing overarching objectives;
- 2) Developing and issuing assignments, plans, procedures, and protocols;
- 3) Establishing specific, measurable objectives for various incident management functional activities, and directing efforts to attain them, in support of defined strategic objectives;
- 4) Documenting results to measure performance and facilitate corrective action;

These objectives require a manageable span of control to ensure all objectives are met.

Per the NIMS, supervisory responsibility should range from three to seven subordinates.

The incident type, nature, hazards, and distances between personnel and resources have a direct influence on the span of control necessary for a given incident (DHS, 2004).

The expansion rate of the incident affects the span of control and the orderly establishment of the required staff components of ICS. These staff positions include Command, Operations, Planning, Logistics, and Finance. Command consists of the aforementioned IC and his or her staff positions: Public Information Officer (PIO), Safety Officer (SO), and Liaison Officer (LNO). The Operations section is responsible for the specific activities focused on the reduction of the immediate hazard, saving of life and property, control of the incident, and restoration of normal operations. The Planning section collects, evaluates, and disseminates information and intelligence and relays the

results of data interpretation to the IC. Logistics is responsible for all support requirements including logistical necessities such as fuel, food, medical services, and any resource from public and or private entities. The Finance section is responsible for procurement, cost-recovery, and administrative support (DHS, 2004).

When an incident reaches the scope of a multi-jurisdictional or multi-agency response, a multi-agency coordination system should be established. This includes the creation of an Emergency Operations Center (EOC) to provide an off-site facility that coordinates information and resources to support the IC. During small-scale incidents, an EOC will not need to be established as the IC is located adjacent to the incident in a safe area and responding agencies can physically report to him or her to assist or support operations. However, when an incident escalates in complexity, the EOC should be established at a fixed facility away from incident to allow for uninterrupted coordination of information and resources by representatives of the responding agencies; thereby allowing for jurisdictional interoperability. EOC's are staffed by the various response capabilities and functional disciplines and includes: fire, law enforcement, EMS, State, Federal, county, etc. The principle functions and responsibilities of multi-agency coordination as listed on page 28 of NIMS (DHS, 2004) include:

- 1) Ensuring each agency involved in incident management activities is providing appropriate situational awareness and resource status information;
- 2) Establishing priorities between incidents and/or area commands in concert with the IC involved;
- 3) Acquiring and allocating resources required by incident management personnel in concert with the priorities established by the IC;

- 4) Anticipating and identifying future resource requirements;
- 5) Coordinating and resolving policy issues arising from the incident;
- 6) Providing strategic coordination as required.

The PIO is an integral part of the Command Staff as he or she is responsible for conveying information from the EOC and IC to responding agencies and the public. This becomes the public information component of ICS. The PIO is responsible for media and public inquiries in addition to information and warnings, rumor monitoring (as was rampant during the events of September 11, 2001), and other communications relevant to accurate and timely information management (DHS, 2004).

Preparedness is the responsibility of the individual jurisdiction. This includes coordinating with other jurisdictional capabilities and private organizations. The goal of domestic preparedness is to establish and coordinate emergency plans and capabilities, establish standards and guidelines for response, and to promote harmonious interoperability. Ensuring the timely establishment of EOCs and information systems is paramount to this goal. Individual jurisdictions should also establish programs and plans that address requirements for planning, training, equipping, exercising, evaluating, and actions to mitigate the myriad of conventional and contemporary threats (DHS, 2004).

Planning should include the development of Emergency Operations Plans (EOP). This includes describing responding jurisdiction(s): organizational structure, responsibilities, policies, and protocols for emergency support. Preparedness plans should be established to determine applicable training needs and evaluation exercises so deficiencies in jurisdictional capabilities can be addressed. Recovery plans can be created to identify priorities regarding life support for casualties, restoration, and growth of

preparedness. Training and exercises should be developed to challenge responding jurisdictions that provide for realistic scenarios to test responders' capabilities. Improving interoperability and integration of the ICS component of NIMS is the fundamental objective. Goals of training and exercise plans should facilitate the following objectives:

- 1) Facilitate the development and dissemination of national standards, guidelines, and protocols for incident management training and exercises, including consideration of existing exercise and training programs at all jurisdictional levels;
- 2) Facilitate the use of modeling and simulation capabilities for training and exercise programs;
- 3) Facilitate the definition of general training requirements and approved training courses for all NIMS users. These requirements will be based on mission-to-task analysis. They will address critical elements of an effective national training system including field-based training on mission-essential tasks, and requirements for specialized instruction;
- 4) Review and approve discipline-specific requirements and training courses (DHS, 2004 pg. 37-38).

The NIMS further describes the fact that preparedness is formulated by nationally recognized, applicable standards for emergency response personnel. This provides assurance that those personnel responding to terrorist attacks, WMD incidents, natural and man-made disasters, and significant fires possess the minimum knowledge, skills, and abilities to mitigate an incident. In accordance with national certification standards, reliance on various types of emergency response equipment requires that said responders'

equipment complies with interoperability requirements and capabilities. This includes equipment that performs with mission-essential tasks such as decontamination, monitoring and detecting hazardous materials, and operating at technically complex rescue scenarios; furthermore, the equipment utilized should be interoperable with other jurisdictions' equipment (DHS, 2004).

Managing resources under NIMS requires that jurisdictions establish systems for activating resources prior to and during an incident, typing resources to ensure resources are capability specific, certifying personnel so that responders possess proper credentialing for the incident(s) they are expected to respond to, and developing plans to mobilize these resources when needed. On-going management of resources and interoperability requirements necessitates that responding jurisdictions adhere to the above principles and concepts of NIMS. This includes the adoption of NIMS in its entirety and conducting training exercises on a continual basis and the development of resources and capabilities to affect the results of adequate domestic preparedness (DHS, 2004).

*Domestic Preparedness: Expert Witness Testimony*

On March 21, 1998, before the Congressional Military Research and Development Subcommittee of the Committee on National Security, then Battalion Chief Ray Downey, Chief in Charge of the FDNY' SOC, testified as to the fire service's role in domestic terrorism involving WMD. Specifically, Chief Downey referenced the 1993 WTC and 1995 Murrah Federal Building bombings, respectively. Chief Downey described the successful responses by both the FDNY and Oklahoma City Fire Department(s) (OCFD), and the fact that not one victim perished in either incident as a result of awaiting rescue

by responding Firefighters. However, had a “dirty bomb” or chemical agent been released during these bombings, the FDNY’s and OCFD’s successful responses would not have been likely. The 1993 WTC bomb did contain chemical agents; however, they were disintegrated in the ensuing blast and did not pose a threat to responders (Committee on National Security [CNS], 1998).

During the 1993 WTC bombing, the FDNY successfully evacuated approximately 50,000 occupants. Of these occupants, 500 were treated at the scene for various injuries and approximately 600 sought treatment at local hospitals on their own accord. Chief Downey posed the question as to the possible effects had these occupants actually been contaminated by a chemical agent. Chief Downey further stated that in 1998, after five years of preparation by fire departments to respond to these incidents, the nation’s fire service was still not adequately prepared. Paralleling this belief, Chief Downey relayed recent testimony from Chief Gary Marrs of the OCFD that the fire service was no better prepared to respond to acts of domestic terrorism involving WMD in 1998 than it was in 1993 and 1995, respectively (CNS, 1998).

*FDNY Response to Domestic Preparedness after September 11: The McKinsey Report*

The attack and subsequent devastation on September 11, 2001 reaffirmed Chief Downey’s assumption that the nation’s fire service is the principal first responder. Post-September 11 expectations of the foreseen consequences of terrorism now assumed by the fire service, the FDNY in particular required a renewed proactive approach. As a result, the FDNY commissioned McKinsey and Company to conduct a five month study of the FDNY’s response to the WTC attacks in early 2002 and establish recommendations to enhance future preparedness. The McKinsey study included

interviews with more than a hundred FDNY personnel and subject matter experts, reviews of sixty hours of communication tapes, and created task forces to develop said recommendations. Notably, the McKinsey report listed a key recommendation to re-evaluate special operations capabilities and expand hazardous materials response (McKinsey and Company, 2002).

The FDNY committed nearly all of its SOC Companies to the WTC on September 11, 2001, including its only unit with advanced hazardous materials capabilities, Hazmat 1. This rendered the entire City of New York unable to respond to another incident requiring advanced hazardous materials capabilities and six of the seven Squads with limited hazardous materials capabilities were committed to the WTC as well. McKinsey and Company stated in its report that special operations units play a crucial role in responses to large and complex incidents, including terrorist attacks. Terrorist attacks and their consequences include those in the aforementioned text as well as the possibility of simultaneous incidents. McKinsey also noted that the current FDNY does not possess the capabilities for the latter consequence (McKinsey and Company, 2002).

The report recommended that the FDNY's Operational Planning Unit determine via a cost-benefit analysis, alternative means of expanding its hazardous materials capabilities even further. One specific alternative in particular was to increase training and equipment on the SOC's Squad Companies. Another relative recommendation was to conduct an analysis of interagency coordination and resources so that a determination could be made as to the length of time the FDNY's SOC could operate alone until it required mutual aid from federal agencies (McKinsey and Company, 2002).

### Chapter III:

#### Methodology

##### *Statement of Problem*

The MFD has successfully decentralized its conventional fire suppression and EMS capabilities through its thirty seven Engine Companies and sixteen Ladder Companies; including those quartered in special team Engine Houses. However, the special teams component of MFD's Bureau of Special Operations has chronologically failed to decentralize its relative, specialized capabilities. The historically decentralized, limited specialized rescue capabilities of early last century consequently regressed into the current centralized construct of three special teams. The result related to said lack of decentralization of the contemporary special teams, since their respective dates of inception, is causal for the inadequate and inefficient utilization of existing Bureau of Special Operation's resources; particularly regarding its apparatus and personnel.

##### *Instrumentation*

A comparative analysis was used to determine the feasibility of incorporating the FDNY's Squad Company model into the MFD's Bureau of Special Operations response(s). The instrumentation was selected due to the availability of established FDNY Squad Company operational and organizational documents; as well as established MFD Bureau of Special Operation's operational protocols and response capabilities.

##### *Data Collection*

Official FDNY SOC and Squad Company response data was obtained through documents available for purchase from a promotional testing service based in New York City that is not affiliated with the FDNY. MFD data consists of Numbered Notices which

are the MFD's established standard operating guidelines; and are available in all MFD Bureaus and Engine Houses.

#### *Data Analysis*

The data from the instrumentation was analyzed in an attempt to determine if study meets the following objectives:

- 1) Determine if the utilization of currently deployed MFD conventional Engine Companies provides for an effective apparatus to decentralize the MFD's Bureau of Special Operation's special team capabilities, including mass decontamination and responses to multiple and simultaneous incidents;
- 2) Determine if the FDNY Squad Company concept provides for the optimum means of utilizing special teams' personnel; particularly those team members not currently assigned to a special team Engine House;
- 3) Compare existing MFD Bureau of Special Operations and FDNY SOC utilization and response protocols to establish an effective response and staffing model for the MFD's deployment of Squad Companies;
- 4) Determine if Squad Company utilization by the MFD would meet established national response standards relative to its requisite and anticipated capabilities.

#### *Limitations*

The FDNY's SOC concurrently deploys five Rescue Companies in addition to its Squad Companies. The data obtained for the study does not reflect utilization of Rescue Companies in specific conjunction with Squad Companies as they consist of specialized apparatus that are not currently deployed in the MFD. The FDNY Rescue Companies' specialized capabilities are equivalent to that of the Squads with some operational

variations specific to their role in SOC. The MFD is currently studying the Rescue Company concept for use within the Bureau of Special Operations to compliment its current centralized capabilities. Henceforth, the study will be performed utilizing the FDNY's Squad Companies exclusively due to their organization and deployment utilizing Engine Company apparatus; apparatus that is currently deployed by the MFD. Moreover, the study will focus on decentralization of the Bureau of Special Operations' special teams through the application of the Squad Company Model.

## Chapter IV:

### Results

#### *Introduction*

The MFD has successfully decentralized its conventional fire suppression and EMS capabilities through its thirty seven Engine Companies and sixteen Ladder Companies; including those quartered in special team Engine Houses. However, the special teams component of MFD's Bureau of Special Operations has chronologically failed to decentralize its relative, specialized capabilities. The historically decentralized, limited special rescue capabilities of early last century consequently regressed into the current centralized construct of the three special teams. The result related to said lack of decentralization of the contemporary special teams, since their respective dates of inception, is causal for the inadequate and inefficient utilization of the existing Bureau of Special Operation's resources; particularly regarding its apparatus and personnel.

The purpose of this study is to provide the MFD's Bureau of Special Operations, specifically its special teams deployment, with an effective means of decentralization of its capabilities. The researcher selected to study the Fire Department of New York's (FDNY) Squad Company concept due to operational success with this particular model in decentralizing its similarly tasked Special Operations Command (SOC). The inclusion of the Squad Company concept into the FDNY's SOC involved the use of existing resources, namely its conventional Engine Companies to affect this decentralization. The MFD did attempt to decentralize early specialized rescue capabilities through the use of conventional Engine Companies by equipping and designating them as "Auxiliary Rescue Squads." However, as previously stated, this early decentralization later

progressed into the MFD's contemporary EMS delivery rather than a mode of specialized rescue decentralization. Relative to the contemporary FDNY's successful redeployment of its existing resources to decentralize its contemporary SOC capabilities, and the successful early decentralization of specialized capabilities in the MFD's historical context, the objectives of the study are to:

- 1) Determine if the utilization of currently deployed conventional Engine Companies provides an effective apparatus to decentralize the MFD's Bureau of Special Operation's special team capabilities, including mass decontamination and responses to multiple and or simultaneous incidents.
- 2) Determine if the FDNY Squad Company concept provides for the optimum means of utilizing special teams personnel; particularly those team members not currently assigned to a special team Engine House.
- 3) Compare existing MFD Bureau of Special Operations and FDNY SOC utilization and response protocols and establish a response and staffing model for the MFD's deployment of Squad Companies.
- 4) Determine if Squad Company utilization by the MFD would meet established national response standards relative to its requisite and anticipated capabilities.

FDNY Squad Company data used for the purposes of this study were obtained from several sources of established policies and procedures; namely the FDNY's Department Orders, All Unit Circular (AUC), and Communications Manual, respectively. The FDNY Department Order number 68 dated June 29, 1998 officially established Engines 18, 61, 252, 270, and 288 as Squad Companies. All Units Circular number 275, addendum 2 (Squad Company Operations) dated May 10, 2004 details the standard operating

procedure, operational assignments, and staffing and recruitment of the Squad Companies. Communications Manual Chapter 7 (section 7.7), dated December 29, 1998 lists the capabilities of the Squad Companies relative to their role in SOC. Communications Manual Chapter 7 (Addendum 1): SOC Unit Response Policy, dated March 10, 2004, lists when Squad Company response to specialized incidents is required.

MFD Numbered Notices relative to Bureau of Special Operations response were used in the comparative analysis to determine the operational similarities between the FDNY Squad Companies and MFD Bureau of Special Operations' capabilities. The specific MFD Numbered Notices analyzed include:

- 1) #2004-35: Hazardous Materials (Haz-Mat) Team Utilization and Response
- 2) #2004-36: Special Calling Car 25 Alone
- 3) #2004-38: Heavy Urban Rescue Team (HURT) Utilization and Response
- 4) #2004-40: Dive Rescue Team Utilization and Response

The above Numbered Notices serve as the MFD Bureau of Special Operation's standard operating procedures for the three special teams.

#### *FDNY: The Squad Company*

During World War I (WWI), the FDNY was experiencing crucial staffing deficiencies due to many Firefighters serving in the Military overseas. In an attempt to alleviate this concern, the FDNY placed in service a "Flying Squadron" consisting of a converted Hose Wagon and up to thirty Firefighters. The Hose Wagon was essentially a conventional Engine Apparatus used during that period with the replacement of hose carried in the rear with bench seats to accommodate the many Firefighters assigned to it. The Flying Squadron's role was that of providing staffing for second alarm fires in

Manhattan and third alarm fires in the Bronx. Although disbanded after WWI, The FDNY soon endured similar staffing shortages successively brought upon by World War II (WWII) and comparable demands on its Firefighters to serve overseas (Calderone, 1999).

To combat these operational and safety concerns, the FDNY established three "Squad Companies," or Squads as they were known, consisting of an Officer and ten Firefighters. Again, the role of the Squads was primarily to provide staffing at fires. The three squads were assigned to conventional Engine Companies temporarily assigned hose wagons similar to that of the Flying Squadron used during WWI. These Squad Companies reverted back to their respective, conventional Engine Companies when Firefighters returned from Military duty. However, the success of the Squad Companies with regards to providing relief for staffing shortages would soon again be relied upon. A study conducted by the FDNY in the mid 1950's revealed a shortage of Fire Companies in specific areas of New York City during instances of simultaneous fires (Calderone, 1999).

Again using converted Hose Wagons, the FDNY placed nine Squad Companies in service from 1955-1961 to alleviate these staffing concerns at fires. However, the use of these Squad Companies slightly varied from previous deployments as they only operated at first alarm fires. As second alarm Fire Companies arrived on scene, the Squads would return to service ensuring they would be available in the event of multiple and simultaneous fires. In 1958, vans replaced the Hose Wagons and in 1966, conventional Engine Company apparatus were used as the FDNY was soon finding its Firefighters

serving again in a time of war; a figurative war within the City of New York proper (Calderone, 1999).

From the period of the 1960's throughout the late 1970's, the City of New York bore witness to unrelenting socioeconomic disorder in the form of indefatigable arson known as "The War Years." Three Squad Companies of the two previous decades were disbanded and their staffing was needed to establish new Fire Companies in areas of the City reeling from the effects of rampant arson and conflagrations. Many of the FDNY's Engine Companies were decimated due to the amount of fire duty experienced during this time and the demand on their role. Assigning Engine Company apparatus to the remaining six Squad Companies gave the FDNY not only crucially needed Engine Company capabilities, but the Squad Company's proven staffing solution as well. The Squads, now with their respective, assigned Engine Company apparatus, began responding in place of specific Engine Companies during certain hours to free others up to respond to simultaneous incidents. However, as the City of New York witnessed an end to the War Years and a subsequent fiscal crisis in 1976, all of the FDNY's Squad Companies were disbanded (Calderone, 1999).

Many other Fire Companies and Firehouses were also disbanded and closed as a result of the fiscal crisis in the late 1970's in New York City. Engine Company 269 in Brooklyn was one of these Companies closed and as a result, sparked a grass-roots protest by the local community affected by its closing. Due to the immense political pressure on City leaders, the FDNY reorganized Squad Company 1 in 1977 in the former quarters of Engine Company 269. Furthermore, the FDNY's conventional role of the Squad Company was updated to include equipping Squad Company 1 with Ladder

Company tools; thereby allowing it to function as either an Engine or Ladder Company on the fireground. Similarly, Engine Company 41 was reorganized in 1990 in the Bronx and paralleled the role of Squad Company 1. However, Engine Company 41 was reorganized under the designation as an “Enhanced Engine Company” rather than a Squad Company initially for reasons unspecified (Calderone, 1999).

In 1998, under a Mayoral Directive, the FDNY was charged as the exclusive City of New York agency tasked with mitigating chemical and biological attacks including decontamination. To comply with this directive, the FDNY found the need to deploy strategically located Fire Companies with the proper training and equipment to mitigate these and related incidents. The FDNY’s historical success with the Squads, and their operationally diverse role in their conventional fire suppression capabilities, led the FDNY to consider their role for this contemporary mission. As a result, on July 1, 1998, almost three months after Chief Downey testified before Congress as to the fire services’ preparedness in responding to terrorism involving WMD, five additional Engine Companies (Engines 18, 61, 252, 270, and 288) were designated as Squad Companies in addition to Squad Company 1. With the resulting, re-designation of “enhanced” Engine Company 41 as a Squad Company, the FDNY’s compliment of Squad Companies now numbered at seven (Calderone, 1999).

Placing Squad Companies in service to affect this new role required training members for a myriad of responsibilities and duties. Members underwent extensive training in both Engine Company and Ladder Company Operations; confined space operations; structural collapse; and hazardous materials response. More extensive training was instituted to include certifying Squad Company members as Rescue and Hazardous

Materials Technicians by the year 2000. The Squad Companies were incorporated into the FDNY's SOC which already operated five Rescue Companies and a Hazardous Materials Company (Hazmat 1); in addition to other support equipment. The resultant benefits included support of Rescue Companies at fires and technically complex rescues. Moreover, Hazmat 1 and Rescue Company 5 were the exclusive Fire Companies tasked with mitigating hazardous materials emergencies. The inclusion of hazardous materials first response capabilities in the Squads enabled them to operate and assist Hazmat 1 as Hazardous Materials Technician Units as well, in a more limited capacity (Downey, 1999).

The re-integration of the Squad Company concept in its current role allows an IC a versatile tool to mitigate not only conventional threats, but contemporary and emergent ones as well. It was on September 11, 2001, however, that the nation watched the unprecedented and laborious task that fell upon the FDNY as it attempted the greatest rescue attempt in the nation's history. At the forefront of this rescue attempt was Chief Downey and the members of his SOC. Chief Downey operated side-by-side with the members of SOC and others from the FDNY who responded on that fateful day and rescued countless lives. All five Rescue Companies, Hazmat 1, six of the seven Squads, and numerous Engine and Ladder Companies were operating in the WTC when both towers collapsed. Tragically, Deputy Chief Ray Downey perished with 342 other Firefighters, or "first responders" as they posthumously became referred to after that day, during an incident he predicted the fire service was not prepared for on March 21, 1998.

*Item Analysis*

*FDNY: Department Order Number 68, June 29, 1998*

On July 1, 1998, the FDNY established Engines 18, 61, 252, 270, and 288 as Squad Companies. The Squad Company number was now at seven with the inclusion of the previously designated Squads 1 and 41, respectively. All Squad Companies were placed under the auspices of SOC with regards to operations and administrative purposes. The Squads were equipped with Ladder Company tools and are trained and equipped to operate as either a Ladder Company or Engine Company. As an Engine Company, they will continue to respond in that role in their respective, established first alarm or assigned response area. The Squads will respond to fires and multiple-alarms in either role per the Bureau of Communications. Effective August 1, 1998, the Squads will also be Haz-Mat Technician Units and assigned a second apparatus for transporting equipment needed for hazardous materials responses. Chief Officers were to be cognizant of the versatility afforded by re-designating these Engines to serve a myriad of functions relative to their training and role in SOC (Fire Department City of New York [FDNY], 1998).

*FDNY: AUC- 275, Addendum 2 (Squad Company Operations), May 10, 2004*

This All Units Circular was established for all Squad Companies as a standard operating procedure for their specific role in the FDNY. This document lists in priority order the following responses of the Squad Companies. Also described is the Squad Company operational assignments and staffing and recruitment. The priority order for Squad Company response is as follows: Engine Company coverage, Certified First Responder-Defibrillation (CFR-D), hazardous materials incidents, Squad Company

response to fires in their SOC assigned area, and technical rescue incidents, respectively (FDNY, 2004).

#### *Engine Company Coverage*

Per AUC-275 addendum 2, Squad Companies will operate as a conventional Engine Company in their assigned first alarm response area. They will operate as an Engine Company per established Firefighting Procedures. Squad Company 1 operates according to this procedure exclusively while Squads 18, 41, 61, 252, 270, and 288 respond as an Engine Company on their first, second, and third due first alarm assignments as well (FDNY, 2004).

#### *CFR-D Coverage*

Squad Companies will operate as the primary CFR-D units in their first due response area. Squad Companies are required to stay within this area unless the SOC Battalion Chief gives permission to leave said response area. Squad Companies are to notify the dispatcher when such instances will occur; and the Battalion Chiefs of the Squad Company's first, second, and third due response area must also be notified to determine response contingencies in the event they will not be available for an alarm (FDNY, 2004).

#### *Hazardous Materials Incidents*

Squad Companies shall augment and provide support for Hazardous Materials Company 1 and operate as the primary hazardous materials response unit in the event Hazardous Materials Company 1 is not available. The members assigned to Squad Companies are trained as Hazardous Materials Technicians including training in the use of Chemical Protective Clothing (CPC). Squad Companies are trained and equipped to

assume an offensive position to mitigate leaks, spills, and releases of hazardous materials (FDNY, 2004).

*Response as a Squad Company to Fires within Their Assigned Area*

When responding to a fire anywhere other than their first alarm or first due response area, the Incident Commander (IC) may use Squad Companies to perform a variety of functions relative to Engine and/or Ladder Company operations. Squad Companies are to note the presence and availability of hydrants in the event the IC orders them to supply hoselines. The Squad Company is to assume a position at an operable hydrant and avoid obstructing other units responding and/or operating at the scene (FDNY, 2004).

*Technical Rescue Incidents*

Squad Companies are certified Rescue Technicians. They are trained in all functions of technical rescue including: Structural collapse, confined space, high angle rope rescue, trench rescue, and other related rescue operations. Inclusive are surface water rescues and the capability of supporting Rescue Companies in SCUBA operations as Dive Tenders. Technical rescue incidents require a Rescue Company as the principle responder to these incidents (FDNY, 2004).

AUC-275 describes the specific Squad Company operational assignments:

*Squad Company Assigned to Other Than Their First Alarm Response Area*

Squad Companies are to be alert to reported difficulties in establishing a reliable, positive water supply for fireground operations. If the Squad Company arrives as the first in Engine Company, the role and duties befall them to place the first handline into operation. If arriving after another Engine Company and no Ladder Company is on scene,

the Squad Company will operate as a Ladder Company to affect forcible entry, ventilation, and search. When operating as a Ladder Company, the following assignments are to be established:

- 1) Forcible Entry Team: Squad Officer, Squad Irons, and Squad Can
- 2) Outside Ventilation: Squad Hook
- 3) Roof Team: Squad Roof and Squad Chauffeur

The IC will advise the dispatcher that the Squad Company is operating as a Ladder Company on the fireground so incoming units are aware of initial operations being accomplished. When later units arrive, the Squad Company may be reassigned to other duties as deemed necessary by the IC (FDNY, 2004).

*Squad Company Arriving at a Fire, No Battalion Chief is on the Scene and Both Ladder Companies are on Scene*

In the event no Battalion Chief has arrived on the scene, the Squad Company Officer assumes IC if he is the senior Officer present. The Squad Company shall assume the same, aforementioned assignments and provide support to operating units. The Forcible Entry Team shall monitor safety conditions for the second due Ladder Company's Floor Above Team and Roof Team, respectively (FDNY, 2004).

*Squad Company Arriving at a Fire and the Battalion Chief is on the Scene*

The entire Squad Company is to report to the Command Post to receive their orders from the IC. The IC may assign the Squad Company to perform any task required. The Squad Company may operate as an entire unit or split up members to be deployed with any unit currently operating remaining available for assignment to other tasks as needed (FDNY, 2004).

### *Squad Company Tools and Assignments*

Tools: All members of Squad Companies are to be equipped with the following on their person:

- 1) Full PPE
- 2) SCBA
- 3) Portable radio
- 4) Hand light
- 5) Carabineer with 24' of 1" tubular nylon webbing
- 6) Personal rope and harness

#### *Forcible Entry Team*

Tools: Halligan, axe, Officer's hand-tool, Hydra Ram, search rope, thermal imaging camera and pressurized water extinguisher if operating as first or second due Ladder Company.

Position: Operations as indicated by the Squad Officer or IC.

#### *Floor above Team*

Tools: Two Halligans, axe or maul, two 6' Halligan hooks, rabbit tool, search rope.

Position: Operate as a team on the floor(s) above the fire floor.

#### *Roof Team*

Tools: Two Halligans, two 6' Halligan hooks, lifesaving rope with safety harness, and saw.

Position: Operate as a team on the roof of the fire building to assist members operating.

Survey roof and surrounding exposures for life hazards and report critical information to all members (FDNY, 2004).

### *Operations at Emergencies*

Squad Company members are equivalently trained as the Rescue Companies. Squad Companies will be dispatched in conjunction with a Rescue Company as determined by the SOC Response Matrix. Squad Companies do not carry the full complement of rescue tools as a Rescue Company but may initiate operations prior to their arrival. Squad Companies will also provide additional support to the Rescue Companies in complex technical rescue operations (FDNY, 2004).

### *Squad Company Staffing and Recruitment*

Due to the unique training requirements for Squad Company Officers and members, all Hazardous Materials Technician Units must meet statutory hazardous materials qualifications. Members must be trained to the basic Rescue Technician level to satisfy OSHA requirements concerning emergencies such as trench cave-ins and confined spaces. SOC maintains a list of qualified Officers to fill vacancies on the Squads. Firefighter vacancies are filled by interested members contacting the Squad Company Captain to request an interview. Members desiring to become Squad Company Firefighters must have completed two years of service with the FDNY. Firefighters considered for assignment to a Squad Company will be detailed for a one month evaluation period not including Rescue School attendance. Staffing levels for Squad Companies is at six personnel, an Officer and five Firefighters, with a minimum of four assigned Squad Company Firefighters maintained every tour. Squad Company members may be assigned to other SOC units to satisfy staffing requirements in the command (FDNY, 2004).

*FDNY: Communications Manual Chapter Seven (Section 7.7), December 29, 1998*

Section 7.7 of the FDNY's Communication Manual describes how the Squad Companies will be dispatched and assigned to an alarm. Squad Companies respond to fires in their first due response or alarm area as well as greater alarms as directed by their respective Borough Dispatcher. Squad Companies respond as CFR-D units in accordance with CFR-D unit protocols and procedures. Squad Companies are also designated Hazardous Materials Technician Units and will be assigned this role by their respective Borough Dispatcher. The IC may special call a Squad Company as needed at an alarm. Squad Companies will not be detained at greater alarms to affect overhaul of the fire or watch-line duties once the fire is declared under control. If a Squad and/or Rescue Company were not originally assigned to a specific fire incident, the dispatcher will assign the closest available Squad and Rescue Company. Second alarm transmissions require a Squad Company response if not done prior to declaring this transmission (FDNY, 1998).

*FDNY: Communications Manual Chapter Seven (Addendum 1-SOC Unit Response Policy), March 10, 2004*

This addendum to the Communications Manual, chapter seven, lists specific types of SOC responses that require an assigned Squad Company. The SOC Response Policy allows members assigned to SOC as well as Borough dispatchers when Squad Companies are needed on an alarm. The following incident descriptions require a responding Squad Company:

*Building Collapse*

- 1) Major: A reported collapse of floors, walls, roofs, and unstable buildings or areas.
- 2) Minor: A report of loose bricks, cornices, facades, siding, etc.

*Pin Jobs (Vehicle Extrications)*

- 1) Reported Pin Job: Auto accidents where person(s) are reported trapped.
- 2) Confirmed Pin Job: Auto accidents where person(s) are trapped and confirmed by Engine or Ladder Company on the scene.

*Entrapments*

Person(s) stuck in a machine, person under train (subway, elevated train), etc.

*Construction Accidents*

Reports of overturned construction equipment, emergencies involving other heavy equipment mishaps, trauma, and impalements at a construction site.

*High Angle Emergency*

Person(s) on scaffolds, stranded on bridge or embankment, ropes, etc.

*Confined Space Emergencies*

Person(s) trapped in confined space emergencies.

*Trench Rescue*

Person(s) trapped in trenches and cave-ins at excavation sites.

*Scuba Rescues*

Person(s) in body of water.

*Hazardous Materials Incidents*

Chemical leaks, person(s) overcome by fumes, odors, etc. and major fuel spills over 100 gallons.

*Ice Rescue*

Person(s) on or through the ice.

*Explosions*

Reports of explosions causing injuries or structural damage.

*Transit Incidents*

Railroads and or transit fires or emergencies requiring evacuation of passengers, particularly in tunnels and under bridges.

*Building/Structural Collapse*

Reports of structural or building collapse.

The aforementioned emergencies will also require the response of a Rescue Company and or Hazardous Materials Company 1 as the principle response unit. As stated above, Squad Companies support these companies and receive equivalent training allowing the IC flexibility to assign Squad Companies as needed (FDNY, 2004).

*MFD: Numbered Notice #2004-35 (Hazardous Materials Team Utilization and Response), June 17, 2004*

The purpose of this notice is to set forth department policy for response and actions taken at hazardous materials emergencies in the City and County of Milwaukee. The Hazardous Materials Team and equipment are quartered at Engine 25. Once an incident is confirmed as a haz-mat incident, a Full Haz-Mat Response will be dispatched to include the following units:

- 1) Battalion Chief
- 2) 2 Engines
- 3) Engine 25 at the Officer's discretion
- 4) Haz-Mat 1
- 5) Car 25
- 6) 1 Paramedic Unit

7) 1 Ladder Company

If Engine 25 is engaged at another incident or alarm, dispatch is to send another Engine Company to relieve Engine 25 enabling them to respond to a confirmed hazardous materials incident (MFD, 2004).

A Limited Haz-Mat Response may also be requested for abandoned barrels and hazardous materials spills in which the product has been identified and does not pose an immediate threat to life or the environment. This assignment includes the following units:

- 1) Haz-Mat 1
- 2) Car 25

In the event of a leaking barrel, the Incident Commander is to request a Limited Haz-Mat Response. Non-leaking barrels require the Incident Commander to attempt to determine the product identification by utilizing warning labels, markings, and occupancy location (MFD, 2004).

It is the responsibility of the first arriving Engine or Ladder Company Officer to perform a size-up according to department S.O.G.'s and first responder responsibilities that include:

- 1) Protect yourself using a safe approach, upwind, uphill
- 2) Identify the chemical and associated hazards. Gather information from placards, container labels, shipping papers, Department of Transportation (D.O.T) Guidebook, and or knowledgeable persons on the scene.
- 3) Secure the area without entering the immediate hazard area. Do what you can to isolate the area and assure the safety of people and the environment.

- 4) Assist the Hazardous Materials Team. Upon arrival of the Haz-Mat Team, provide assistance as requested (MFD, 2004).

The Haz-Mat Officer may request additional team members as needed by requesting their response through the assigned Battalion Chief in command of the incident. When a fire department unit is on the scene of an incident involving hazardous materials not indicated by the original call, the Company Officer may request:

- 1) Telephone resource assistance from Engine 25 (Hazardous Materials Team)
- 2) Car 25 alone response
- 3) Limited Haz-Mat Response
- 4) Full Hazmat Response (MFD, 2004).

A request for the MFD Hazardous Materials Team may be made by any city or suburb outside of the City of Milwaukee proper. Such requests must be made by the Incident Commander of said municipality's fire department. State of Wisconsin regional response protocols are to be followed by the on duty Hazardous Materials Team Officer. The on-duty Firefighting Deputy Chief and Car 18 (Battalion Chief of Special Operations) will be notified and the Hazardous Materials Team will coordinate operations with the ranking Officer in which the incident occurs (MFD, 2004).

*MFD: Numbered Notice # 2004-36 (Special Calling Car 25 Alone), June 17, 2004*

Car 25 is available to respond to small spills. The purpose of this guideline is to explain the circumstances for calling Car 25 alone. Car 25 is available for special call from units in the field for gasoline spills of less than 25 gallons and recoverable. Car 25 is also available for response for leaking gas tanks also releasing less than 25 gallons. Car

25 possesses the capability to absorb and dispose of common petroleum products such as diesel fuel, anti-freeze, motor oil, etc.; Again, in quantities less than 25 gallons. When special calling Car 25 alone, the Engine or Ladder Company Officer should transmit the quantity and description of the product to the dispatcher (MFD, 2004).

The Engine or Ladder Officer on the scene should request a Limited or Full Hazmat response as described in the preceding text per the “Haz-Mat Team Utilization and Response” Numbered Notice. For smaller spills, refer to the Numbered Notice entitled “Petroleum Spill Absorbents.” The primary reason Engine or Ladder Companies should request Car 25 alone is its availability to dispose of the above products at a reasonable cost. Car 25 also possesses the capability to transfer liquid between containers (MFD, 2004).

*MFD: Numbered Notice #2004-38 (Heavy Urban Rescue Team Utilization and Response), June 17, 2004*

The HURT team has the capability, training, and equipment to respond to the following technical rescue incidents:

- 1) High-Angle Rope Rescues
- 2) Low-Angle Rope Rescues
- 3) One-Point Suspension with Litter Tender
- 4) Structural Collapse Rescue
- 5) Confined Space Rescue
- 6) Trench Rescue

It is the responsibility of the dispatcher and on scene Engine and Ladder Companies to perform a size-up of the incident to determine its exact nature. This information will

determine a HURT Team response if one or more of the aforementioned scenarios is present. Once an incident is deemed to require the HURT Team response, the following units will be dispatched:

- 1) Battalion Chief
- 2) Closest Engine Company
- 3) Closest Ladder Company
- 4) Paramedic Unit
- 5) Engine Company 12
- 6) Ladder Company 11
- 7) HURT 1
- 8) HURT 2

All personnel assigned to the quarters of Engine 12 will respond with Engine 12, Ladder 11, HURT 1, and HURT 2 to all HURT incidents (MFD, 2004).

Upon arrival of the HURT Team, the ranking HURT Officer will confer with the IC and formulate an operational plan. The plan will encompass initiating or completing a rescue and or recovery of the victim(s) in a safe and expeditious manner. The HURT Team Officer will determine if additional HURT Team members not assigned to the quarters of Engine 12 are needed and request on or off-duty members through dispatch (MFD, 2004).

When an incident occurs outside the City of Milwaukee proper, the IC from the requesting municipality will be responsible for control of the incident. The MFD will maintain absolute control over all HURT operations. All operating MFD units will

remain under the control of the ranking MFD Officer present. The following are the MFD standard operating procedures for first responders in the City of Milwaukee:

- 1) Identify the need for a “rescue.” There must be a “victim.”
- 2) Special call the HURT Team.
- 3) Secure the area and initiate a site safety plan and incident command system.
  - a) Safety perimeter
  - b) Staging area
  - c) HURT operation area
  - d) EMS triage, treatment, and transport area
  - e) Control “would-be” rescuers
  - f) Beware of secondary collapse at trench and other collapse incidents
- 4) Secure utilities
- 5) Extinguish fires
- 6) Provide EMS
- 7) Do not enter any un-shored trench
- 8) Do not enter any confined space unless absolutely certain that no hazard exists or that any identified hazards have been effectively neutralized (MFD, 2004).

*MFD: Numbered Notice # 2004-40 (Dive Rescue Team Utilization and Response), June 17, 2004*

Dive Rescue Team members and equipment are quartered at Engine 3 and respond to all water-related emergencies. The purpose of this notice sets department policy for responses and actions taken in and around the City of Milwaukee’s waterways. Once an incident is determined by dispatch, and or confirmed by units on the scene, a

Dive Response will be dispatched. If Engine 3 is operating at another alarm, the dispatcher will send another Engine Company to relieve Engine 3 for their response to a dive incident. The following units will be assigned on a Dive Response:

- 1) Battalion Chief
- 2) Support Battalion Chief
- 3) Dive Rescue 1 and 2
- 4) Fireboat
- 5) Closest Engine Company
- 6) Ladder 1, 2, or 11 depending on which one is closest to the incident
- 7) Paramedic Unit
- 8) Additional Companies via special call
- 9) Engine 3 will remain in quarters out of service (MFD, 2004).

A Dive Response will be dispatched when received from a credible and reliable witness person(s) in the water or on the ice. It is the responsibility of the first arriving Engine or Ladder Company Officer to size-up the incident and determine if a Dive Response is warranted. The Dive Team Officer will determine once arriving at the scene if additional on or off-duty Dive Team personnel are needed. The Dive Team Officer is to request this through the IC and dispatch (MFD, 2004).

#### *Vehicle in Water*

If the Dive Team is notified of a vehicle in the water, a determination must be made as to whether or not all occupants have been removed from the vehicle. Once the status of occupants is determined, the Dive Team can prepare the vehicle for removal

from the waterway by a towing company. Once the vehicle is secured, the scene can be left in the custody of the Milwaukee Police Department (MFD, 2004).

#### *Daniel Hoan Bridge Emergency*

If an incident involves a reported suicide by jumping from the Daniel Hoan Bridge, the closest available Engine Company is to be dispatched to the top of the bridge. This Engine Company will act as a communication liaison between law enforcement and the MFD and attempt to determine the suspected location of the victim. Other responding units are to remain staged at Henry Maier Festival parking lot until requested on the scene (MFD, 2004).

#### *Out of City Response*

When an incident occurs outside the City of Milwaukee proper, and a request is made for the MFD Dive Rescue Team, the MFD will coordinate its efforts with the ranking Officer of the requesting municipality. The MFD will have absolute control over all MFD Dive Rescue Team operations (MFD, 2004).

#### *Comparative Results*

The study yielded several comparative results pertinent to the study's objectives; particularly with regards to the specialized capabilities, apparatus types deployed, and personnel utilization of the MFD's Bureau of Special Operations and the FDNY's SOC. Both departments possess relatively the same specialized response capabilities with exception given to training, equipment, and apparatus. The FDNY currently operates a Technical Rescue School at its Fire Academy to train Squad and Rescue Companies in becoming Rescue Technicians. The MFD at present does not operate such a school as relative, specialized training is acquired either "in-house" or through established training

centers and schools outside of the MFD. Moreover, this training for the Bureau of Special Operation's special teams is coordinated administratively through the Battalion Chief of Special Operations and operationally by each individual special team Director, respectively. Each respective special team maintains and coordinates its own training specific to its individual, centralized response requirements only.

Apparatus deployed to both departments' special operations incidents varied considerably. The FDNY SOC deploys two distinct types of apparatus initially to these incidents. Initial response to most of the aforementioned incident types in the FDNY SOC Response Matrix necessitated response by a Squad Company in conjunction with a Rescue and or Hazardous Material Company 1. The FDNY SOC does possess other support apparatus and equipment to assist the Rescue and Squad Companies including the Squad Companies' "second-piece" apparatus that carries their respective hazardous materials equipment. However, these support apparatus and equipment are requested through a special call by the SOC Battalion Chief.

The MFD varies considerably in regards to the apparatus types it deploys to a special operations incident and regards the type of incident posed. The Dive Rescue Team, quartered at Engine 3, operates a Dive Rescue Company (Dive 1) that is essentially a Rescue Company apparatus with dive rescue capabilities and equipment exclusively. The Dive Rescue Team also deploys a pick-up truck (Dive 2) that has towing capacity for the Dive Rescue Team's inflatable rescue boat(s). The HURT Team deploys its assigned Engine Company 12 and Ladder Company 11; in conjunction with a pick-up (HURT 2) truck that tows stored lumber for collapse and shoring operations and a refurbished beverage shipping truck (HURT 1) to carry its technical rescue equipment.

The Hazardous Materials Team deploys a tractor trailer vehicle (Hazmat 1) that carries most of its hazardous materials equipment, computers, and chemical protective clothing. In conjunction, it deploys its assigned Engine Company (Engine 25) and a pick-up truck (Car 25) that tows support and decontamination equipment.

The method(s) of deploying personnel to special operations incidents also varied considerably between departments. The FDNY with its current SOC Response Matrix allows for all on-duty SOC members on duty in the FDNY to respond on a Rescue, Squad, or Hazardous Materials Company. Squad Companies in particular allow for SOC members to respond to virtually any incident facing the FDNY from an individual apparatus to initiate and or support operations; with a minimum of six personnel assigned to each Rescue and or Squad Company. Squad Companies will however respond with four personnel leaving two personnel to simultaneously respond with their assigned “second-piece” apparatus if required for the incident.

The MFD however deploys its aforementioned special team apparatus with only those members specifically assigned to a respective special team Engine House. The Dive Rescue Team responds with Dive Rescue 1 and 2 and its inflatable rescue boat(s) with only five personnel and must place Engine Company 3 out-of-service to affect this. The HURT Team responds with nine personnel dispersed among the following units: Engine 12, Ladder 11, HURT 1, and HURT 2. The Hazardous Materials Team responds with five personnel to deploy Engine 25, Hazmat 1, and Car 25.

Due to the MFD operating three mutually exclusive, centralized special teams from three Engine Houses, there exists no specific or documented method or capability to respond to multiple or simultaneous incidents requiring their response(s). If the FDNY

SOC must request additional assistance at an incident, it needs only to dispatch another Rescue and or Squad Company. There are seven Squad Companies throughout New York City with equal staffing levels, training, and response capabilities due to decentralization of the SOC's resources to respond to multiple and simultaneous incidents. In the MFD however, requesting and acquiring assistance for special operations incidents is haphazard at best. When more Bureau of Special Operations personnel are needed at the scene, these personnel must come from other Engine Houses located throughout the MFD and City of Milwaukee, respectively. Each special team maintains varying roster numbers. With the exception of those assigned to a special team Engine House, other members of the three special teams are assigned to conventional Engine and Ladder Companies in the MFD. Once a request for more assistance occurs, a series of problematic events begins.

The on-scene special team Director or Officer must request additional team members through the IC. The IC then communicates this request through the dispatcher and the request is sent via computer to all thirty-six Engine Houses in the MFD. Any Engine House in the MFD may vary as to any special team members working on any given day. It becomes the responsibility of the Engine House Officers to call the dispatcher and relay the number of team members working in their respective Engine House and their availability to respond. The responding team members' Battalion Chiefs will coordinate transportation of these members in Battalion vehicles; usually requiring numerous stops at various Engine Houses throughout the City of Milwaukee to acquire special team personnel. This consumes a tremendous amount of critical time during the incident until these members arrive.

The use of MFD Bureau of Special Operations and FDNY Squad Company personnel also varied with regards to their role(s) at structural fires. The FDNY also deploys its Squad Companies to all structural fires as well as special operations incidents. As stated above, this offers the IC the flexibility to assign Squad Company members to any task or operation that may be required. Squad Companies possess both Engine and Ladder Company tools and equipment and have the ability to perform as either, as needed. At present, the MFD does not initially dispatch its special teams to fires unless the fire progresses to a third alarm or greater. In this instance, only the HURT team will respond and assumes the role as the RIT and is not assigned to initiate or support fireground operations.

FDNY Squad Companies and MFD Engine and Ladder Companies provide EMS response in their first due response area. With regards to EMS responses upon concluding operations at a special operations incident, the FDNY Squad Companies have a distinct operational advantage over MFD special teams' Engine Companies. FDNY Squad Companies are available as a cohesive Fire Company to respond to an EMS alarm upon returning to quarters. MFD special teams however, are not available for such responses until all team members' return to their respective quarters to staff their assigned Engine and or Ladder Companies.

FDNY Squad Companies also have the ability to respond to a special operations incident upon taking up from an EMS or fire alarm due to their cohesive staffing and apparatus response model. MFD special teams' personnel must first return to their respective quarters to drop off personnel to respond with the requisite apparatus needed at a special operations incident. This delay is significant when viewing these incidents from

a life safety perspective as prompt arrival of special teams' personnel becomes paramount to the mission of the MFD and first responder.

## Chapter V:

### Discussion

The MFD has successfully decentralized its conventional fire suppression and EMS capabilities through its thirty seven Engine Companies and sixteen Ladder Companies; including those quartered in special team Engine Houses. However, the special teams component of MFD's Bureau of Special Operations has chronologically failed to decentralize its relative, specialized capabilities. The historically decentralized, limited specialized rescue capabilities of early last century consequently regressed into the current centralized construct of the three special teams. The result related to said lack of decentralization of the contemporary special teams, since their respective dates of inception, is causal for the inadequate and inefficient utilization of existing Bureau of Special Operation's resources; particularly regarding its apparatus and personnel.

The impetus of the study was a review of the historical and contemporary challenges facing the MFD, particularly its Bureau of Special Operations. The Bureau of Special Operations is tasked with responding to and mitigating practically every emergency and threat to the City of Milwaukee proper that falls outside the scope of conventional fire suppression. Since the inception of the Bureau of Special Operation's current special teams, no attempt at decentralization has occurred. This study was an attempt to determine if the FDNY's utilization of Squad Companies, and its apparent success in decentralizing its own special operations capabilities; would compliment the MFD Bureau of Special Operation's response by utilizing its available resources and personnel more efficiently and effectively.

The study proceeded with a review of the literature relative to the types of both conventional and contemporary responses, practices, and standards affecting specialized response with regards to their demands on today's fire service. In the contemporary fire service, fire departments have witnessed demands on their service necessitating their response to mitigate a multitude of threats to their respective municipalities. Most notable is its current designation as the principle first responder to acts of terrorism and WMD. It is incumbent on fire departments to meet these conventional and contemporary demands by determining the most efficient and effective method(s) of deploying their resources and personnel. In performing the study as to the benefits of using Squad Companies to decentralize the MFD Bureau of Special Operations' capabilities, there were some significant limitations to the study.

#### *Limitations*

The FDNY SOC also deploys five Rescue Companies that serve as the primary response unit to special operations incidents. The role of the Squad Company is that of a support unit at these emergencies with the exception of hazardous materials emergencies where as Hazardous Materials Company 1 is the principle response unit. Squad Companies have the same capabilities and training however, to assume the role of the principle response unit in the absence of a Rescue Company and or the Hazardous Materials Company. The reason for the Squad Company's designation as a support unit to the Rescue Companies is the fact that it does not carry the full complement of tools and equipment as that of the Rescue Companies. The MFD is currently researching the feasibility of incorporating the Rescue Company concept into its Bureau of Special Operations. Their incorporation however is most likely intended to compliment the

existing centralized construct of the current special teams. This study did not, as a limitation, research the effectiveness and utilization of Rescue Companies and their potential capabilities in the MFD in conjunction with implementing the Squad Company concept.

Another limitation of the study involves the unavailability and use of response time data to quantify the delays in acquiring more special team personnel at an incident, including response delays to multiple and simultaneous responses. These response times should also be studied to develop further rationale for the need to decentralize the special teams of the Bureau of Special Operations. It is believed that these times would vary greatly and would be a significant contribution for further study as well.

The FDNY, during the time this study was performed, began deploying and augmenting the Squad and Rescue Companies with SOC support Ladder Companies and Hazmat Technician Unit Engine Companies. These Fire Companies have decentralized the SOC's capabilities even further. Their role in SOC is to assist in special operations by aiding in support operations previously performed exclusively by the Squads and Rescues. This allows for the Squads and Rescues to focus solely on the most problematic and complex aspects of the incident. Further study should be performed as to the effectiveness of implementing both the Rescue and Squad Company concepts into the MFD Bureau of Special Operations as well as consideration of support Engine and Ladder Companies. The latter introduction to the FDNY's SOC provides a poignant example of the significance and need to decentralize special operations capabilities to meet the aforementioned contemporary demands on today's fire service.

### *Recommendations*

The study was able to satisfy all of its objectives by providing rational solutions and specific examples for them. In response to the success in satisfying the objectives, it is a recommendation of the study that the FDNY Squad Company concept provides a feasible method of decentralizing the MFD Bureau of Special Operations special team capabilities and response. The historical and contemporary utilization of Squad Companies by the FDNY has proved their success in decentralizing the SOC's capabilities and response to meet the aforementioned conventional and contemporary demands of today's fire service.

*Objective #1: Determine if the Utilization of Currently Deployed MFD Conventional Engine Companies Provides for an Effective Apparatus to Decentralize the MFD's Bureau of Special Operations' Special Teams Capabilities, Including Mass Decontamination and Responses to Multiple and Simultaneous Incidents*

The use of conventional Engine apparatus to incorporate the Squad Company concept into the MFD makes their use both operationally and economically responsible. Engine Companies in the MFD number thirty-seven. Designation of selected Engine Companies already in service in the MFD as Squad Companies provides for an economically responsible alternative; this is due to the fact that no new, costly apparatus must be purchased to incorporate the Squad Company concept. As responses and equipment change to meet future demands, new Squad Company apparatus can be purchased, however, this is not an initial concern in decentralization. Moreover, utilization of existing resources is cost effective due to the current fiscal constraints facing the City of Milwaukee and the MFD, respectively.

Utilizing Engine Companies already in service in the MFD allows for no loss of Engine Company and EMS coverage in selected companies first due response area(s). Furthermore, no Engine Companies will have to be re-deployed to other areas of the City of Milwaukee. The FDNY was able to decentralize the SOC by selecting Engine Companies that were already strategically located to provide effective special operations response throughout the City of New York. A significant finding of the study was the ability of the FDNY to deploy its decentralized capabilities without interrupting or eliminating its established, conventional ones. Another significant, relative point is that the MFD would not suffer the loss of the Engine Company coverage currently afforded by the special teams' respective, assigned Engine Companies.

As stated above, utilizing Engine Companies with established first response areas provide for an operationally conducive means of decentralizing the Bureau of Special Operations' capabilities. Selected Engine Companies re-designated as Squad Companies can respond to not only in Engine Company and EMS response capacities, but as an apparatus capable to respond to any threat facing the City of Milwaukee, anywhere in the City. The MFD can deploy a Squad Company(s) in conjunction with Dive Rescue 1, HURT 1 and 2, and or Hazmat 1 that have the requisite equipment carrying capacities, allowing the Squad Companies to initiate and support special operations incidents. Recommended use, assignments, positions, capabilities, and recruitment of personnel will be described in the proceeding text.

The MFD has recently acquired, through Federal grant awards, three mass decontamination trailers. As of late, the MFD has no method or strategy of deploying these trailers. Each decontamination trailer carries two tents bringing the total number of

tents to six. Incorporating Squad Companies into the MFD would provide an acceptable means of deploying, operating, and maintaining these tents with personnel trained in their use and the hazards posed during decontamination operations. Moreover, deploying these tents with Squad Companies ensures that they will be available on the initial responses necessitating their use, even in the event of multiple incidents. During the initial response to hazardous materials, terrorism, and WMD incidents, mass decontamination of affected victims and responders is a principle operation.

Responding to multiple and simultaneous incidents requiring the capabilities and response of the special teams is not feasible under their current centralized construct. Having Squad Companies with the ability to respond to any and multiple special operations incidents is paramount to meet current and future threats facing the City of Milwaukee. This ensures the safety and well-being of both first responders and citizens alike; a pledge already made to the City of Milwaukee by the MFD in its current mission statement.

*Objective #2: Determine if the FDNY Squad Company Concept Provides for the Optimum Means of Utilizing Special Teams' Personnel; Particularly Those Team Members not Currently Assigned to a Special Team Engine House*

The Squad Company concept provides an acceptable alternative to the current utilization of special team personnel. As stated in the preceding text, the special teams operate as mutually exclusive entities within the MFD. Each special team carries varying roster numbers of individuals with the capabilities to respond only in their respective team's capacity and role at special operations incident. Each special team Engine House varies in the numbers assigned to them as well due to the types and number of apparatus

currently deployed out of their quarters. By decentralizing these special team Engine Houses, all areas of the city will be afforded all of the capabilities of the Bureau of Special Operations from several locations.

Each Squad Company will have the ability to respond to any special operations incident with all of the Bureau of Special Operations current capabilities on a single apparatus. This will require cross-training assigned personnel in all facets of the Bureau of Special Operations capabilities. There are currently several special teams' personnel that belong to at least two of the special teams. This fact proves that cross-training is both feasible and effective. Having special teams personnel with the ability to operate at every special operations incident aids tremendously in overall operational efficiency and expertise.

Bureau of Special Operations training will also become more efficient and streamlined with the incorporation of Squad Companies. Currently, members not assigned to a special team Engine House must place themselves out-of-service from their respective Engine and Ladder Companies to receive training at their special teams Engine House or training location. This in turn forces their Engine or Ladder Company to respond with fewer personnel or operate minimally staffed until their return the quarters upon concluding training. Moreover, this training occurs only once a month due to the logistical and problematic process of freeing up these personnel to attend training. Training in special operations responses requires an immense amount of training due to the inherent complexities associated with the requisite skills. The current training cycles of the special teams does not currently provide the optimum amount of training. Furthermore, the logistical problems of getting these personnel to their respective special

team Engine House for training have caused many members to resign their positions on the special teams. Squad Company utilization would surely aid in retention of these members due to relief of said logistical problems of acquiring requisite training.

Assigning these special teams personnel to Squad Companies allows for infinite opportunities to train due to the fact that these personnel are all assigned to a single apparatus. No Engine or Ladder Companies would run minimally staffed during training and the current logistical concerns are no longer present due to the Squads staffing solution. Squad Company utilization would also allow for an increase in the number of personnel assigned to the Bureau of Special Operations as training these personnel would be streamlined throughout the Bureau. Members would also be able to train in all areas of special team capabilities as a cohesive company due to the assignment of cross-trained personnel to the Squads. As members join the Bureau of Special Operations, they will have the fortunate opportunity to be assigned to one of the Squad Companies as well as the units quartered at the current special team Engine Houses. This provides the Bureau of Special Operations with the on-duty staffing to respond to multiple and simultaneous incidents; with all of these available personnel without undergoing the current process of transporting members from throughout the city to these incidents.

The current special team Engine Houses would still quarter Dive Rescue 1, HURT 1 and 2, and Hazmat 1 as these companies must remain in service due to their ability to carry the requisite specialized equipment that can not be carried by the Squad Companies. The centralization of these units in their current respective quarters will still allow for decentralization of the Bureau of Special Operations; as the utilization of re-designated Engine Companies as Squad Companies serves to decentralize their

capabilities, the principle purpose of this study. The benefit of the Squad Companies is that response to multiple and simultaneous incidents and more efficient training and use of personnel could be accomplished.

Squad Companies would also allow for better use of those promoted out of a special team Engine House. At present, when a Firefighter is promoted to Heavy Equipment Operator (HEO) or Lieutenant, he or she will be assigned in that capacity to a non-special team Engine House if no vacancies are available at their respective special team Engine House. This fact is currently detrimental as the experience and training of this Firefighter leaves the respective special team with them and they will no longer be available during the initial operations at a special operations incident. By decentralizing the teams with Squad Companies, more promoted personnel can be assigned to the Bureau of Special Operations to fill vacancies as they occur due to vacations, holidays, and paid-off days keeping their expertise and experience immediately available anytime they are on-duty.

As vacancies occur in the Bureau of Special Operations, interested members desiring assignment to a Squad Company will be interviewed by the Battalion Chief of Special Operations and placed on an eligibility list. Members selected will be detailed to the Bureau of Special Operations, provided with the requisite training and certification, and upon successful completion assigned to a Squad Company vacancy. Squad Companies will maintain at least four assigned Bureau of Special Operations Firefighters each shift, maintaining a minimum staffing of five personnel. Another staffing option could include assigning a Paramedic with special operations capabilities to the Squad Companies. This would provide all capabilities of the Bureau of Special Operations on a

single unit complementing efficient operations with regards to the Squad Companies EMS capabilities.

*Objective #3: Compare Existing MFD Bureau of Special Operations and FDNY SOC Utilization and Response Protocols to Establish an Effective Response and Staffing Model for the MFD's Deployment of Squad Companies*

It is a recommendation of this study to incorporate four Squad Companies into the MFD's Bureau of Special Operations. The following Engine Companies would be selected for acceptable designation as Squad Companies: Engine Company 5, Engine Company 22, Engine Company 31, and Engine Company 38. These Engine Companies were selected because they are currently quartered as Single Engine Houses. This allows the Squad Companies to be quartered by themselves to allow room for decontamination trailers and equipment storage, without relocating Ladder Companies. They are also geographically located to provide special operations coverage in all of the MFD's six Battalions. In the event of multiple responses, the closest, adjacent Squad Company would be dispatched in the event the first due assigned Squad Company is already operating at another alarm. Moreover, the ability to assign two Squad Companies on two simultaneous incidents can be accomplished with these selected Engine Companies.

Each Squad Company will respond with a minimum of five personnel. This staffing solution ensures that the Squad Officer will be available to oversee Squad Company Operations with four other personnel to operate in teams of two for safety. The Squad Companies will be capable of responding with the following response capabilities:

- 1) Water rescues as Dive Tenders and surface ice rescues
- 2) High-angle rope rescues

- 3) Low-angle rope rescues
- 4) One-point suspension with litter tender
- 5) Structural collapse rescues
- 6) Confined space rescues
- 7) Trench Rescues
- 8) Hazardous materials emergencies
- 9) Mass decontamination
- 10) Rapid Intervention
- 11) Engine Company Operations
- 12) Ladder Company Operations
- 13) Emergency Medical Services
- 14) Vehicle Extrication

The following positional and minimum tool assignments will be used to designate Squad Company Personnel:

- 1) Squad Officer/Safety
  - i. Thermal Imaging Camera
- 2) Forcible Entry Team/Nozzle Team/Entry
  - a. Squad Irons
    - i. Flathead axe
    - ii. Halligan
  - b. Squad Can
    - i. Pressurized water extinguisher
    - ii. 6' Hook

### 3) Outside Team/Back-up Entry

- a. Squad HEO
  - i. 6' Hook
  - ii. Halligan
  - iii. Roof or Metal Saw
- b. Squad Vent/Door
  - i. Halligan
  - ii. 6' Hook

Positional and tool assignments for technical rescue operations, vehicle extrications, EMS, dive and ice rescues, and hazardous materials emergencies will follow the above nomenclatures in assigning personnel as Entry, Back-up, and Line Tenders or any other position(s) as needed. Two Squad Companies will be dispatched on the report of a confirmed victim(s). Squad Companies will also be assigned on all full assignments to structure fires.

When Squad Companies are operating as the first, second, or third due arriving Engine Company, they will follow current MFD standard operating guidelines for Engine Company operations. When arriving before the first or second due Ladder Companies on a full assignment for a structure fire, they will assume the respective arrival position(s) and duties with exception of roof ventilation until arrival of a Ladder Company per MFD standard operating guidelines. Once a Ladder Company arrives, they can be assigned to any task as designated by the IC. When arriving after the third due Engine Company and second due Ladder Company, the Squad Company will assume the role of the RIT. If not initially available to assume the role of the RIT, another Squad Company will be

available to respond for this role. Consideration should be given to establishing a water supply to place a hoseline in service to affect RIT operations if needed. The Squad Officer will report to the IC to relay their presence on the fireground; The Squad Officer and Squad Can will then perform a RIT size-up and advise the IC of any hazards or safety issues. The remaining Squad Company personnel will begin removal of these hazards including but not limited to: laddering the building for means of egress, removal of window bars, forcing entry, etc. The assignment of a Squad Company to the role of RIT frees up the currently utilized and assigned RIT Ladder Company to perform their fundamental roles of search and rescue, ventilation, etc.

*Objective #4: Determine if Squad Company Utilization by the MFD Would Meet Established National Response Standards Relative to their Requisite and Anticipated Capabilities*

Chapter II of the study introduced several relative response standards regarding special operations incidents. Squad Company utilization in the MFD's Bureau of Special Operations would satisfy the requisite criteria of these standards.

*NFPA 1710: Standard for the Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*

Two criteria found in this standard are the types of special operations responses that are classified as special operations and the requirement to establish a RIT team. The MFD's Bureau of Special Operations currently possesses all of these response capabilities through the collective of the three mutually exclusive special teams. Squad Company utilization would meet this standards definitions and response requirements,

including RIT, on a single apparatus, a factor realized in the FDNY and unrealized in the MFD.

*NFPA 471: Recommended Practices for Responding to Hazardous Materials Incidents*

The crux of this standard dissects a hazardous materials incident into three distinct zones of operation: Hot, warm, and cold zones. To operate in the hot and warm zones, members must meet the criteria set forth in the accompanying NFPA 472 standard. Currently, the Hazardous Materials Team is the only special team with the certification and training to operate in the hot and warm zones of a hazardous materials incident. Furthermore, operations in the hot zone require specialized metering and protective equipment that would be carried on all Squad Companies. All members assigned to Squad Companies would be able to operate in all operational zones with the requisite equipment without awaiting the initial response of only five personnel from the Hazardous Materials Team.

As stated above, the request and time delays in transporting more Hazardous Materials Team to the scene limits the number of personnel available to operate in these zones. Escalating incidents would be more efficiently mitigated by simply dispatching more Squad Companies to assist with operations. NFPA 471 also lists the requirements of decontamination operations. With the Squad Companies possessing the ability to transport and operate the new decontamination tents, this operation will be performed in requirement of this standard; particularly with the fact that per this standard, decontamination must be present during the entire hazardous materials incident.

*NFPA 472: Standard for Professional Competence of Responders to Hazardous*

*Materials Incidents*

Training requirements set forth by this standard require that all members responding to and operating at hazardous materials incidents possess certain levels of training commensurate with their responsibilities at these incidents. All members of the Hazardous Materials Team are minimally trained to the Hazardous Materials Technician level. Requirements of Hazardous Materials Technicians fall under five key responsibilities at a hazardous materials incident:

- 1) Identify the response objectives;
- 2) Identify potential action options available by response objective;
- 3) Select the appropriate level of PPE for given action option;
- 4) Select the appropriate decontamination procedures (physical or chemical);
- 5) Develop a plan of action.

All Squad Companies, namely the Squad Officers will be able to initiate these five responsibilities on the initial alarm. With the response of Hazmat 1, these responsibilities will be implemented in conjunction with their response. When any special operations incident involves hazardous materials, the need to special call the Hazardous Materials Team, and suspend operations until their arrival, is eliminated with the initial response of a Squad Company.

*NFPA 1670: Standard on Operation and Training for Technical Search and Rescue Incidents*

This standard defines the minimum requirements of fire departments to respond to technical search and rescue incidents. Specifically the following incident types: Structural collapses, rope rescues, confined space emergencies, water search and rescues, and trench rescues, all response types mitigated by two of the three current special teams, the HURT

Team and Dive Team with regards to water rescues. Squad Companies would have the capabilities to initiate these response requirements of this standard in conjunction with hazardous materials and RIT response. The latter usually requiring the skills defined by this standard to affect its successful inclusion in fireground operations.

*NFPA 1006: Standard for Rescue Technician Professional Qualifications*

This standard was included in the study due to the HURT Teams current qualifications as Rescue Technicians. It is also relevant to the study in the fact that all FDNY SOC personnel are also qualified to this level. Members assigned to Squad Companies would have to receive initial training as Rescue Technicians before their assignment to a Squad Company making this concept's incorporation into the Bureau of Special Operations a compliance of this standard.

*National Incident Management System*

Managing resources under NIMS requires that jurisdictions establish systems for activating resources prior to and during an incident, typing resources to ensure resources are capability specific, certifying personnel so that responders possess proper credentialing for the incident(s) they are expected to respond to, and developing plans to mobilize these resources when needed (DHS, 2004). The Squad Company concept provides for the above system of resource activation, capability match up, and certification by streamlining responses through an individual unit(s) with all the requisite capabilities to respond to any emergency.

Resource activation in the current centralized special teams model limits their effectiveness in this requirement of the standard; as there is no measurable method of determining how many special team personnel are available to respond on any given day.

A significant disclosure after this standards introduction to the nation was the contingency that to receive federal funding, including grants for public safety initiatives, was only awarded under incorporation of this management system into a municipality's response.

### *Summary*

As has been demonstrated in this chapter, the incorporation of the Squad Company concept provides an acceptable alternative in decentralizing the MFD's Bureau of Special Operations special teams capabilities. It is these capabilities themselves that must be decentralized and the Squad Company concept successfully accomplishes this by utilization of existing resources in the MFD, namely its conventional Engine Companies. Engine Companies make up the largest apparatus resource in the MFD; and with their established response areas, allow for conventional services to be performed and uninterrupted in conjunction with multiple special operations response capabilities.

It is also economically responsible to consider this concept as it allows for the MFD to meet current and future threats facing the City of Milwaukee with little or no initial significant financial burden. The FDNY has met its obligation to the City of New York in meeting these threats and continues to decentralize further in anticipation of future demands. The MFD can see decentralization of its capabilities come to fruition with the Squad Company concept and in doing so, will adhere to the mission statement it created and valiantly stands by; protecting people and property as Milwaukee's first responder.

## References

- Buck, G. (2002). *Preparing for biological terrorism: An emergency services guide*. Albany, NY: Delmar/Thompson Learning.
- Calderone, J. A. (1999). Special apparatus: The Squads. *With New York Firefighters, 1<sup>st</sup>/99*. 24-25.
- Centers for Disease Control. (2000). *Biological and chemical terrorism: Strategic plan for preparedness and response*. (Morbidity and Mortality Weekly Report). Washington, DC: Author.
- Committee on National Security. (1998). Military research and development subcommittee for the committee on national security: Federal response to domestic terrorism involving wmd training for first responders witness statement. [On-line]. 9/5/2004. Available: [www.fas.org/spp/starwars/congress/1998\\_h/3-21-98downey.html](http://www.fas.org/spp/starwars/congress/1998_h/3-21-98downey.html).
- Department of Homeland Security. (2003). *The national strategy for the physical protection of critical infrastructures and key assets*. Washington, DC: Author
- Department of Homeland Security. (2004). *National incident management system*. Washington, DC: Author.
- Downey, R. M. (1999). The squads: A year later. *With New York Firefighters, 2<sup>nd</sup>/99*. 6-8.
- Federal Emergency Management Agency. (2001). *United States Government Interagency Domestic Terrorism Concept of Operations Plan*. Emmitsburg, MD: Author.
- Fire Department City of New York. (1998). *Department order no. 68*. New York: Author.
- Fire Department City of New York. (1998). *Communications manual chapter 7: Squad Companies*. New York: Author.

- Fire Department City of New York. (2004). *All unit circular 275 addendum 2: Squad company operations*. New York: Author.
- Fire Department City of New York. (2004). *Communications manual chapter 7 addendum 1: SOC unit response policy*. New York: Author.
- Fredericks, A. A. (1999). Engine company support of rit/fast operations. *Fire Engineering*, 152, 79-96.
- Maryland Emergency Management Agency. (2004). Glossary of terms. [On-line]. 8/13/2004. Available: [www.mema.domestic-preparedness.net/glossary/html](http://www.mema.domestic-preparedness.net/glossary/html).
- McKinsey and Company. (2002). Mckinsey report. *Fire Department City of New York Official Website*. [On-line]. 9/19/04. Available: [www.nyc.gov/html/fdny/html/home2.shtml](http://www.nyc.gov/html/fdny/html/home2.shtml)
- Milwaukee Fire Department. (2004). Executive summary. *City of Milwaukee Fire Department Official Website*. [On-line]. 6/17/2004. Available: [www.milfire.com](http://www.milfire.com)
- Milwaukee Fire Department. (2004). *Numbered notice #2004-35: Hazardous materials team utilization and response*. Milwaukee, WI: Author.
- Milwaukee Fire Department. (2004). *Numbered notice #2004-36: Special calling car 25 alone*. Milwaukee, WI: Author.
- Milwaukee Fire Department. (2004). *Numbered notice #2004-38: Heavy urban rescue team utilization and response*. Milwaukee, WI: Author.
- Milwaukee Fire Department. (2004). *Numbered notice #2004-40: Dive rescue team utilization and response*. Milwaukee, WI: Author.
- Milwaukee Fire Department. (2004). *Training manual*. Milwaukee, WI: Author.
- Nailen, R. L. & Haight, J. S. (1971). *Beertown blazes: A century of Milwaukee firefighting*. Milwaukee, WI: NAPCO Graphic Arts, Inc.

- National Association of County and City Health Officials. (2001). *Elements of effective bioterrorism preparedness: A planning primer for local public health agencies*. Washington, DC: Author.
- National Fire Protection Association. (1997). *NFPA 471: Recommended practice for responding to hazardous materials incidents*. Quincy, MA: Author.
- National Fire Protection Association. (1997). *NFPA 472: Standard for professional competence of responders to hazardous materials incidents*. Quincy, MA: Author.
- National Fire Protection Association. (2003). *NFPA 1006: Standard for rescue technician professional qualifications*. Quincy, MA: Author.
- National Fire Protection Association. (2004). *NFPA 1670: Standard on operations and training for technical search and rescue incidents*. Quincy, MA: Author.
- National Fire Protection Association. (2001). *NFPA 1710: Standard for the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career departments*. Quincy, MA: Author.
- Office of Domestic Preparedness. (2002). *Emergency responder guidelines*. Washington, DC: Author.
- Putchinski, P. (2003). History of the Milwaukee Fire Department Special Teams. Symposium conducted at the May 2003 Annual Fire Bell Club Meeting, Milwaukee, WI.
- United States Fire Administration. (2003). *Rapid intervention teams: And how to avoid needing them: Special report series*. Emmitsburg, MD: Author.
- United States Nuclear Regulatory Commission. (2003). *Fact sheet on dirty bombs*. Washington, DC: Author.

U.S. Army Soldier and Biological Chemical Command. (2000). *Guidelines for mass casualty decontamination during a terrorist chemical agent incident*. Washington, DC: Author

U. S. Army Soldier and Biological Chemical Command. (2003). *Risk assessment of using firefighter protective ensemble with self-contained breathing apparatus for rescue operations during a terrorist chemical agent incident*. Washington, DC: Author.

WMD First Responders (2000). WMD information capsules. *WMD First Responders*. [On-line]. 8/14/2004. Available: [www.wmdfirstresponders.com/WMD-Infocaps.html](http://www.wmdfirstresponders.com/WMD-Infocaps.html).