FIRE FIGHTER FATALITIES
West Helena, AR
May 8, 1997

FIRE INVESTIGATIONS
NATIONAL FIRE PROTECTION ASSOCIATION

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3 Fatalities

Prepared by

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National Fire Protection Association

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ABSTRACT

On Thursday, May 8, 1997, the West Helena Fire Department responded to a reported fire at a pesticides repackaging facility. An explosion occurred as fireground operations were beginning. As a result, four fire fighters were struck and buried by debris. One of the fire fighters was rescued but seriously injured, and the other three died before they could be rescued. The building was destroyed by the fire and explosion.

The building involved was approximately two years old and of unprotected, noncombustible construction. Most of the building's area was used for storage of product. However, in one small production area where pesticides were repackaged there were several offices in the building. The building was served by a wet-pipe sprinkler system.

Facility personnel discovered a smoking sack of commodity in the facility's receiving area and attempted to extinguish the smoldering fire before calling the fire department at 1:02 p.m. In response, the West Helena Fire Department sent an engine, and several fire fighters drove to the scene in their own vehicles. The West Helena fire chief reported smoke showing upon arrival and requested a full response from the West Helena Fire Department and mutual aid assistance from the Helena Department.

The explosion occurred as the West Helena fire fighters approached the building to investigate the source of the smoke. Four fire fighters were struck and buried by debris. West Helena and Helena fire fighters were able to rescue one fire fighter. The other three were buried under debris that could not be removed quickly. The fire was rapidly growing, and the incident commander believed it involved chemicals that posed a high risk to all fire fighters in the area. As a result, the incident commander ordered everyone withdrawn before the last fire fighters could be removed and he kept all personnel at a safe distance until a hazardous materials response team from West Memphis, Arkansas, arrived.

Since fire fighters could not attack the fire and the smoke was considered to be extremely toxic, the focus of the fire department turned toward protecting the community from exposure. City, county, and state law enforcement and emergency management agencies were notified. Evacuation of areas that could be exposed to the
smoke was initiated. The local hospital was one of the many facilities in the evacuation zone.

When the West Memphis hazardous materials response team arrived, they assessed the situation and planned a fire attack to determine whether they could extinguish the fire. Their attack had no effect on the fire so the team decided that they could not extinguish the fire. Instead, they concentrated on recovering the three victims. This was successfully completed.

The fire gradually decreased as it consumed the fuel, and by noon on Sunday, May 11, 1997, only smoldering spot fires remained.

Based on the NFPA's investigation and analysis of this fire, the following significant factors were considered as having contributed to the loss of life and property in this incident:

• Inadequate size-up
• Delayed alarm
• Ignition of material
• Proximity of fire personnel to building containing identified hazardous materials
• Lack of a rapid intervention crew
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I. INTRODUCTION

The National Fire Protection Association (NFPA) has a long-standing fire investigations program. Under this program, the NFPA documents incidents and analyzes significant factors that resulted in the loss of life and property. The NFPA also reports lessons learned that will affect life safety and the prevention of property losses.

The NFPA became aware of the West Helena fire on the day it occurred. The day after the fire Edward Comeau, Chief Fire Investigator, and Michael S. Isner, Senior Fire Investigator, from NFPA’s Fire Investigations Department, and Stephen N. Foley, Senior Fire Service Specialist from NFPA’s Public Fire Protection Division, traveled to West Helena, Arkansas, to perform an on-site study of this incident. Documentation from that two-day, on-site study and subsequent analysis of the data gathered were the basis for this report. Entry to the fire scene and data collection activities were made possible through the cooperation of the U. S. Environmental Protection Administration.

This report is another of the NFPA’s fire studies having particularly important educational or technical interest. All information and details regarding fire safety conditions are based on data gathered during the on-site activities and on any subsequent information obtained during the report development process. It is not the NFPA’s intention that this report pass judgment on, or fix liability for, the loss of life or property resulting from the West Helena fire. Rather, the NFPA intends that its report present the findings of its data collection and analysis effort and highlight factors that contributed to the loss of life or property.

Current NFPA codes and standards were used as criteria for this analysis so that conditions at the facility on the day of the fire could be compared with state-of-the-art fire protection practices. It is recognized, however, that these codes and standards may not have been in effect during construction or operation of the West Helena facility. The NFPA has not analyzed the West Helena facility regarding its compliance with the codes and standards in existence when it was built or during its operation.

The cooperation and assistance of the West Helena Fire Department, U. S. Environmental Protection Administration, Helena Fire Department, and West Memphis Fire Department are greatly appreciated.
II. BACKGROUND

Occupancy Classification

The building involved was a pesticides repackaging facility. Pesticides were brought into the facility in intermediate bulk containers (IBC’s), apportioned into smaller containers for customer use, and packaged for shipment. No pesticides were manufactured at the facility. In addition to the warehouse area, the facility housed a small processing room where the containers were filled and several offices. Since the majority of the building was used for warehousing incoming supplies and outgoing repackaged product, the building will be classified as an “existing storage facility” in accordance to the 1997 edition of NFPA 101®, Life Safety Code®.

The Commodity

The pesticides repackaged in this facility were manufactured at other industrial plants and included approximately 30 types of pesticides. The following are some of the chemicals used in these pesticides:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Other Hazard</th>
<th>NFPA 704 Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azinphos Methyl 50W soluble</td>
<td>Potentially fatal if inhaled or swallowed-CNS damage</td>
<td>Health-4, Fire-0, Reactivity-0</td>
</tr>
<tr>
<td>Aluminum tris (O-ethyl phosphonate)</td>
<td>Not Available</td>
<td>Health-3, Fire-1, Reactivity-0</td>
</tr>
<tr>
<td>Methomyl</td>
<td>Potentially fatal if inhaled or swallowed-CNS damage</td>
<td>Health-4, Fire-0, Reactivity-0</td>
</tr>
<tr>
<td>Triflumizole</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>1-Naphthyl N-methylcarbamate</td>
<td>Flash Point 379°F</td>
<td>Health-2, Fire-1, Reactivity-0</td>
</tr>
<tr>
<td>Ethyl hydrogen phosphonate</td>
<td>Not Available</td>
<td>Health-2, Fire-0, Reactivity-1</td>
</tr>
<tr>
<td>Manganese ethylenebisdithiocarbamate (75%)</td>
<td>May ignite when exposed to water/air. Extremely flammable.</td>
<td>Health-2, Fire-3, Reactivity-1</td>
</tr>
</tbody>
</table>
The Building

The building involved (which was referred to as Unit 2) was approximately 2 years old and of unprotected, noncombustible construction. It was approximately 80 ft (24 m) wide, 100 ft (30 m) long and 20 ft (6 m) high. Most of its area was used for storage of product. The warehouse area had unprotected steel columns and roof structural members. This area was connected to two adjacent buildings, referred to as Satellite 1 and Satellite 2, by two passageways.

The walls in this warehouse were constructed of nonbearing masonry block from grade to an approximate height of 12 ft (3.6 m). Above this point, the warehouse’s exterior walls were composed of a combination of sheet metal panels and translucent panels. The walls for the process and office areas were bearing walls constructed on masonry block. According to NFPA 220, Standard on Types of Building Construction, 1995 edition, the entire building will be classified as Type II (000) construction.

A Type II (000) structure will have a 0-hour fire rating for the exterior bearing walls (first digit); a 0-hour fire rating for structural frame or columns and girders supporting loads for more than one story (second digit); and a 0-hour fire rating for the story assembly (third digit).

The exterior of the buildings were a combination of sheet metal and translucent panels.

The building was located at the end of a dead-end road in an industrial park that contained other chemical warehouses and chemical manufacturing facilities. The building had no exposures to the southeast. To the southwest there were two buildings
The Building

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The exterior of the buildings were a combination of sheet metal and translucent panels.

The building was located at the end of a dead-end road in an industrial park that contained other chemical warehouses and chemical manufacturing facilities. The building had no exposures to the southeast. To the southwest there were two buildings
connected to the fire building. To the northwest, approximately 50 ft away, was a large shed constructed of structural steel support members covered with lightweight steel panels. Farther to the northwest of this building was another structure that was referred to as Unit 5. The structural system in the building could not be verified, but the exterior was covered with lightweight steel panels similar to those of Unit 1 and 2.

Fire Protection Systems

According to the owner, the building was protected by a ceiling-level sprinkler system. Due to the damage and the hazardous materials conditions, it was not possible to make entry into the scene to verify the sprinkler system design or obtain copies of the building’s structural plans.

Building Occupants

At the time of the fire, the building was occupied by 50 employees.

West Helena Fire Department

The West Helena Fire Department had 11 career members and 12 volunteer members. The career fire fighters worked one day on, and two days off (24 hour shifts with 48 hours off-duty.) On the day of the fire, 2 career fire officers and 2 career fire fighters were on duty, which was the typical staffing for a shift. The fire department had four engines (Pumpers 3, 4, 5, and 6), an equipment van (Unit 1), the chief’s car (Unit 2), a utility vehicle (Unit 7), and a rescue van (Unit 8).

Like many of the other rural fire departments in the area, the West Helena Fire Department did much of its training with other fire departments. The initial training for career fire fighters was conducted in conjunction with the neighboring fire departments. The West Helena Fire Department had recently constructed a new self-contained breathing apparatus (SCBA) training facility for use by its members and those of other fire departments.

In addition to the regional training, the West Helena fire fighters received two hours of mandatory training during every shift. This training addressed a multitude of topics, including area familiarization, and fire-fighting skills. Two of the fire fighters killed in this fire had received technician-level hazardous materials training, and the other fire
fighter had received operations level training, according to the fire department. The records also show no recent refresher training.

Some West Helena fire fighters also attended the Arkansas state fire training school in Camden and participated in hazardous materials training. According to the fire department, all of the career fire fighters had received Fire Fighter II level training. Five of the career fire fighters were technician level. Four of the volunteers had been trained to operational level, and the other eight had received recognition level training.

It was reported that the personnel were equipped with protective clothing that included helmets, gloves, boots, coats, trousers, and SCBA.

**Helena Fire Department**

The Helena Fire Department had 17 career and 14 volunteer members. Five career fire fighters were assigned to each shift, which has a rotation of 24 hours on duty and 48 hours off duty. The department’s two chief officers worked during normal business hours, five days a week, and were on call at the other times. The department operated three engines, 55-ft (16.7-m) elevated platform with a pump, a chief’s vehicle, and the county’s light rescue vehicle.

All career fire fighters received training up to the Fire Fighter II level at the Arkansas fire training school in Camden. At the time of the fire all career fire fighters had received state certifications for hazardous materials recognition training, and many were state certified at the hazardous materials operations level. The volunteer fire fighters had completed an introduction to fire-fighting course and received additional training in personal protective gear, wildland fire fighting, and hazardous materials recognition.

**Weather Conditions**

On the day of the fire, the high temperature was approximately 78°F (24°C) and the skies were clear. Humidity was at 57% and the winds were calm.
III. THE FIRE

Discovery and Occupant Activities

At approximately 12:50 p.m. on Thursday, May 8, 1997, several employees in the building designated as Unit 2 observed greenish-yellow smoke coming from a 1600 lb. (725 kg) intermediate bulk container (IBC) containing azinphos methyl. The IBC was in the building receiving area. The employees reported a very pungent odor, and they evacuated the building.

Several employees reported seeing another employee with a fire extinguisher. It is unknown, however, whether this person made any attempt to extinguish the fire.

In reviewing statements made by the employees, several stated that it was approximately 15 minutes after they evacuated the building that the fire department apparatus arrived on the scene.

Fire Department Notification and Response

At 1:02 p.m. the West Helena Fire Department (WHFD) received a call reporting the fire. In response to that call, WHFD dispatched one engine. Several WHFD fire fighters also responded directly to the scene in private vehicles. The West Helena fire chief reported yellow-colored smoke showing upon arrival and requested additional WHFD units to respond and mutual aid assistance from the Helena Fire Department (HFD).

Two WHFD units that responded to this alarm and were staged in the street (Phillips County Rd. 324), side by side. According to statements from the WHFD, the units did not connect into the hydrant, and no handlines were advanced off the apparatus.

Personnel from the facility met with the WHFD chief and provided him with MSDS sheets on the commodity reportedly involved in the incident. He was told that the commodity was not explosive and that the primary hazard was inhalation. The chief then ordered his personnel to don SCBA’s prior to approaching the structure.

The information contained in this section was obtained from interviews conducted by NFPA’s investigators with the fire fighters, officers, and fire chief of the Helena Fire Department. Personnel from the West Helena Fire Department were not available at this time, but copies of their statements were provided to NFPA. Additional information was obtained from an interview with the West Memphis Hazardous Materials Team coordinator who was on the scene. Further information was provided by the EPA incident commander and from access to information being gathered during the incident mitigation phase.
At this time the chief observed a yellow dust, not smoke, emanating from the building. The chief requested that additional personnel and equipment be dispatched to the scene, including mutual aid from HFD.

The chief stated that the fire personnel were being sent to size-up the situation and that no lines were being advanced for fire attack.

The HFD chief and his driver were in the immediate vicinity of the building in a command vehicle (F1) monitoring the radio traffic when the initial alarm to WHFD came in. When the West Helena chief requested that additional units from WHFD and HFD be dispatched, the Helena chief and his driver responded immediately from approximately 3/4 of a mile away. Both the chief and his driver observed yellow smoke emanating from Unit 2, and the chief directed the driver to position the vehicle on the road to the northeast of the occupancy, facing outward, in the event that they had to evacuate.

As the HFD chief approached the scene, he saw two WHFD engines parked in front of the building and several private vehicles operated by WHFD fire fighters. The fire fighters appeared to be in the process of setting up for a fire attack. The HFD fire chief also saw yellow smoke coming from the building. He approached the WHFD fire chief, who was the incident commander, and asked what he and his responding fire fighters could do. The incident commander gave the HFD fire chief several material safety data sheets (MSDS’s) and asked him to read them to determine what type of hazards the fire fighters might be facing.
Location of the fire department units following the explosion.
The view of the building from the intersection of the road located to the north of the fire occupancy.

The HFD chief returned to his vehicle and read the MSDS's. Based on this information, he believed that the fire fighters were facing materials that posed primarily toxicological hazards for which they were not properly protected. One of the sheets included information on a product that, if ignited, would emit yellow smoke. The Helena chief also believed that a withdrawal of fire fighters would be appropriate. He told his driver to reposition their vehicle at a greater distance from the building and went to inform the incident commander of his assessment of the material that he had just read.

As the HFD chief approached the incident commander, he saw four WHFD fire fighters near the building. These fire fighters appeared to be observing conditions, and not attempting to attack the fire. The explosion occurred at this time, and a huge ball of fire and smoke mushroomed from the building. The four fighters were struck by flying masonry blocks and other debris and were buried under the material.
A view of the incident scene from the approximate position of the Incident Commander.

The HFD chief reached the incident commander’s position and was told that fire fighters were trapped. Some WHFD fire fighters quickly placed a handline into operation and attempted to keep the fire away from the area in which the fire fighters were buried. Other WHFD fire fighters attempted to uncover and remove the injured fire fighters. The HFD fire chief radioed Helena Engine 3, told them that fire fighters were down, and instructed them to lay a supply line.

Personnel from WHFD advanced a supply line to the hydrant in front of the fire building. Helena Engine 3, which was close to the industrial park when the explosion occurred, saw the fire and smoke mushroom into the air. Upon arrival, Helena Engine 3 stopped at the hydrant located at the intersection of Phillips County Road 72B and Phillips County Road 324. They began laying a 5 in. supply line from this hydrant as they continued down the road to the fire occupancy. The engine was positioned in the road to the north of the scene. The HFD fire chief immediately ordered that the engine’s deck gun be directed towards the fire building and had it charged from the tank water while the supply line was being connected. The other three fire fighters on Engine 3 put on full protective gear and went to the area where the WHFD fire fighters had been buried. The fire chief’s driver went to Engine 3 and set up an unattended
oscillating ground monitor nozzle that was aimed at the fire spreading to the west end of the building.

As the Engine 3 fire fighters approached the building, they found the WHFD fire fighters still using a 2-1/2 in. hoseline to protect the area where the fire fighters were buried. Personnel from HFD, wearing full personal protective equipment, proceeded to travel toward the end of the road to the southwest. They walked around a large stack of pallets and toward the exterior east corner of the fire occupancy where there were reported trapped fire fighters. A WHFD fire fighter, using a handline, was lobbing water over the stacked pallets to provide protection for the crews approaching the building.

A view of the damaged building from the area where a fire fighter was lobbing water into the fire using a handline.

The HFD personnel reported that as they approached the building it was fully involved with fire. Additional, smaller explosions occurred as they approached and during the subsequent rescue operations. They also found that the four fighters were partially buried under wall sections, broken masonry blocks, structural steel, and other debris. The WHFD fire fighters in the area attempted to unsuccessIfully remove the debris. The HFD fire fighters concentrated their efforts on the fire fighter covered by the least amount of debris. This was also the only fire fighter from which a WHFD emergency
medical technician (EMT) could detect a pulse. As they attempted to free the buried fire fighter, the fire in the building continued to grow and small explosion like noises could be heard inside. Once rescuers freed the buried fire fighter, they brought him out of the hazardous area.

According to available records, 11 fire fighters were injured, suffering strains and sprains, during the rescue effort.

An air ambulance company sent a helicopter to the scene. The helicopter was landing by the time the fire fighter was rescued. After initial treatment and stabilization, the injured fire fighter was transported to a hospital by the air ambulance.

The fire fighters continued their rescue attempts of the remaining three buried fire fighters. After the removal of the one injured fire fighter from the hazardous area, the Engine 3 fire fighters told command that the other three fire fighters could not be uncovered without the use of power equipment. They also reported that vital signs could not be found on any of the buried fire fighters. Considering this information, the severity of the still growing fire and the information obtained from the MSDS, the incident commander ordered all personnel to evacuate the fire area and to withdraw to a distance he believed would be safe. After this point, no one was allowed into the immediate area of the building. During this process, command was transferred to the Helena fire chief.

Since fire fighters could not attack the fire and the smoke was considered to be extremely toxic, the incident commander’s focus turned toward protecting the community from exposure. He requested the assistance of the West Memphis, Arkansas, hazardous materials response team. In addition, he had following agencies notified:

- Phillips County Office of Emergency Services
- Arkansas Office of Emergency Services
- U.S. Environmental Protection Agency
- Arkansas Environmental Protection Agency
- Phillips County Sheriff’s Office

Fire fighters and local law enforcement personnel began evacuating personnel from the area in most immediate danger of exposure to the contaminated smoke coming from this fire. As the severity of the risk was realized and more resources became available, an
area within a two-mile radius on the downwind side of the scene was evacuated. One of the many facilities in the evacuation zone was the local hospital.

The hospital was 100-bed facility that provided a full spectrum of medical care including general medical, surgical and emergency services. At the time of this fire 44 patients were in the hospital. The hospital had prepared a disaster plan intended to guide its staff through all foreseeable disasters and emergencies including a total evacuation of the hospital building. The plan identified alternative facilities to which the hospital could move its entire operation, the roles and responsibilities for all staff, logistical issues, and more. The disaster plan was reviewed and updated annually, with the last review having occurred in March 1997.

When the hospital was notified of the need to evacuate the entire facility, the disaster plan was activated and staff began to perform their appointed tasks. The four patients in the hospital's intensive care unit were transferred to other hospitals. Thirty patients were moved to the hospital's alternative facility, which was established in buildings at a local college campus, and 10 patients were released after being evaluated by medical staff and approved for early release. Ambulances, buses, and other vehicles required in the disaster plan were quickly gathered to transfer patients and supplies. All patients had been relocated or released within one hour after the hospital received its initial notification for evacuation. Staff were allowed back into the hospital on Saturday, May 10, 1997, after testing for contaminants provided negative results. Once back at the hospital the staff thoroughly cleaned the facility.

The West Memphis, Arkansas, hazardous materials response team was notified at approximately 2:00 p.m. on the day of the incident.

Five state-certified hazardous materials technicians and one state-certified operations person responded with the department's hazardous material vehicle. While en route, team members began using the U.S. Department of Transportation Hazardous Materials Guide and CAMEO to research the reported chemicals. They could see the column of smoke when they were about 15 miles from the scene.

The hazardous materials team arrived at approximately 3:15 p.m. After being briefed with respect to the events that had occurred, a member of the team performed an aerial reconnaissance of the site. During this flight the team member observed a green liquid, which was later determined to be a dye, flowing from the building. Other crew
members in Level A protective gear approached the building to view the scene from the
ground and to take air samples. With the information gained through these activities,
the hazardous materials team assessed the situation and decided to perform a “test” fire
attack to determine whether they might be able to extinguish the fire. The team
developed an attack plan, ensured that medical and safety personnel were assigned,
established an emergency evacuation signal, constructed a decontamination area, and
ensured that other precautions were in place before they began their fire attack.

Members of the hazardous materials team, in Level B protective gear, placed two
master stream nozzles at predetermined locations. Once the equipment was in place,
2,000 gpm (7,570 L/min) was discharged by each nozzle for 10 minutes. The time
was approximately 7:40 p.m. After the master stream nozzles were shut down, the fire
was viewed from the air and ground for a second time. Based on their observations,
the hazardous materials team believed that their “test” attack had no effect on the fire
and that the fire therefore could not be extinguished by these tactics.

The hazardous materials team then concentrated on recovery of the three victims, and
they were able to successfully complete this task by approximately 12:00 a.m. The
West Memphis hazardous materials team left the scene at approximately 1:00 a.m., and
control of the scene was returned to the Helena Fire Department. By this time the fire
had decreased and primarily involved debris piles. Because there was little that the
Helena Fire Department could do at this point, control of the scene was transferred to a
hazardous materials recovery company that had arrived on the scene.

The fire buried in the debris continued to burn and smolder. On Friday, control of the
fire scene was turned over to the Environmental Protection Agency’s Emergency
Response Team from Denton, Texas. Air monitoring was conducted, and a “hot zone”
was established around the building.
A view of the damage caused by the explosion.

During the evening hours, the EPA incident commander decided to have three Helena fire fighters make entry into the scene to evaluate conditions. The plan was to identify the fire's location within the debris and to use aerial apparatus place water upon the fire. The fire fighters were outfitted in Level B protective equipment. No other fire-fighting personnel or command officers were on the scene; backup was to be provided by personnel from the hazardous material contractor on site. The only fire apparatus available on scene was an aerial truck staffed by these three fire fighters, that had to be jump-started earlier in the day.

The three fire fighters made entry into the scene. Based on their evaluation it was decided not to place any water on the fire at this time and to allow the fire to continue to smolder.

On Saturday, May 10, another private hazardous materials response team arrived on site. Based on their air monitoring, and the properties of the material involved, they expanded the hot zone beyond the area originally established by EPA. Entry using Level A protective equipment was conducted to evaluate the site.
A much more organized incident command structure was also established. Because a number of federal, state, and private organizations on the scene, it was necessary to coordinate all activity around this incident to ensure personnel safety.

On Sunday, May 11, 1997, heavy equipment was brought in to uncover the hot areas. As the structural steel and other debris were removed, the exposed burning material was spread out in a safe area, allowing the heat to dissipate and quickly extinguish the fire. The last smoldering fire was extinguished on Wednesday, May 14, 1997.

Casualties

Three West Helena fire fighters died as a result of the explosion. Preliminary information indicated that the cause of death was blunt trauma or traumatic asphyxiation. The fourth West Helena fire fighter sustained critical injuries; at the writing of this report he has partially recovered from those injuries.

One Helena fire fighter injured his back during the rescue efforts, and four others were transported to the hospital for exhaustion injuries. File reports show ten injuries transported to hospital.

Sixteen civilians were injured.

Damage

The building was destroyed by the fire and explosion. All records pertaining to sprinkler system design, fire alarm system design, etc. were destroyed in the fire. No copies were available for evaluation.
IV. TIME LINE

1:02 p.m. 911 call from facility
1:02 p.m. Pumper 5 dispatched to incident.
1:06 p.m. West Helena police notified. Private ambulance dispatched to the scene
1:09 p.m. Pumper 5 on the scene
1:10 p.m. West Helena fire chief on the scene. MSDS sheets reviewed and plant management consulted.
1:10 p.m. WHFD chief requests equipment van and additional personnel to respond
1:11 p.m. Pumper 3 responds to scene
1:16 p.m. Pumper 3 on the scene
1:17 p.m. WHFD chief requests that Helena Fire Department respond, mutual aid
1:18 p.m. HFD chief on the scene
1:18 p.m. MSDS sheets evaluated
1:19 p.m. WHFD chief requests state police to respond
1:22 p.m. Explosion occurs
V. DISCUSSION

Based on NFPA’s investigation and analysis of this fire, the following significant factors are considered to have contributed to the loss of life and property in this incident:

- Inadequate size-up.
- Delayed alarm (notification of fire department)
- Ignition of material
- Proximity of personnel to building
- Lack of a rapid intervention crew

Size-up

Based on statements gathered during the investigation, upon arrival at the facility yellow colored smoke was seen coming from the building. The entire facility was not viewed from a distance in order to gather specific information on terrain, wind direction, and general layout of the facility. Instead resources were committed immediately while the information-gathering process was still ongoing. Just as it was discovered that the materials most likely involved were dangerous and the best course of action was to take a defensive stance, the explosion occurred.

The most important tactic in a response to a hazardous materials incident is to conduct a comprehensive size-up. Without basic information on the situation, materials involved, and circumstances surrounding the emergency, incorrect decisions can be made, resulting in additional damage or loss of life.

In responding to an incident involving hazardous materials, several functions should be completed before any control, containment or confinement of the materials is undertaken. All would fall under the category of size-up. These functions include controlling access to the scene, identifying the material(s) involved and determining whether intervention is worth the risk to personnel (risk vs. benefit analysis). And even if intervention is found to be worth the risk, whether the necessary equipment available, both personnel protective equipment and that which would be needed to intervene would have to be determined.
Pre-planning

Major disasters involving hazardous materials, are rare. The more common incidents that occur daily throughout the world involve releases or fires on a much smaller scale. Because local emergency service agencies are the first to respond to these “everyday” incidents and additional assistance from other agencies can be hours away, a program of preplanning target hazards (i.e., fixed facilities) or potential hazards (i.e., transportation routes) within the response district takes on added importance. A basic knowledge of a facility or hazard allows responders to preplan strategy and tactics. Plans can range from detailed written plans for sophisticated hazards or facilities to standard operating guidelines for general responses to hazardous materials incidents.

Other Factors

Although not directly connected with the loss of life and property damage that occurred, several other factors were observed by NFPA’s investigators during their on-site visit.

The fire scene was turned over to the EPA while there was still active fire within the debris. The EPA attempted to formulate a plan for reconnaissance and suppression using the limited resources available to them. However, the personnel involved were not familiar with fire-fighting operations, and they lacked the proper resources to conduct proper operations until the arrival of the private hazardous materials response team.

After the arrival of the hazardous materials team, the “hot zone” was expanded because the air monitoring to evaluate the level of airborne hazards had been insufficient. Personnel then entered the building in fully encapsulated Level A protective clothing to conduct air monitoring.
Entry into the building to conduct air monitoring by personnel in fully encapsulated Level A protective clothing.

A comprehensive incident management system was not established until several days after the explosion. An expanded incident management system was one of the requirements of the private hazardous materials team before they would start operations, to ensure that everyone was adequately protected and that sufficient safety steps had been taken.

To ensure that proper safety procedures are followed throughout an incident’s mitigation and recovery phases, it is vital that a strong, central command structure be established and adhered to at all times. Such a command structure is necessary to provide for the safety of all of the personnel involved in the incident. Hazardous materials incidents can be extremely resource-intensive. Furthermore, experts from a number of areas may have to be called for assistance and input into the process. Coordinating all these resources and personnel can be a very daunting task but can be simplified through the use of the incident management system.
VI. NFPA DOCUMENTS

The following is a list of NFPA documents that contain information relating to fire department operations at incidents such as the West Helena Fire Fighter Fatality incident.

| NFPA 471 Recommended Practice for Responding to Hazardous Materials Incidents | This recommended practice applies to all organizations that have responsibilities when responding to hazardous materials incidents and recommends standard operating guidelines for responding to such incidents. Planning procedures, policies, and application of procedures for incident levels, personal protective equipment, decontamination, safety, and communications are specifically covered in this recommended practice.

The purpose of this document is to outline the minimum requirements that should be considered when dealing with responses to hazardous materials incidents and to specify operating guidelines for responding to hazardous materials incidents. It is not the intent of this recommended practice to restrict any jurisdiction from using more stringent guidelines.

The recommendations contained in this document should be followed by organizations that respond to hazardous materials incidents and by incident commanders responsible for managing hazardous materials incidents. |
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<tr>
<td>NFPA 472 Standard for Professional Competence of Responders to Hazardous Materials Incidents</td>
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hazardous materials branch officers, hazardous materials branch safety officers, and other specialist employees.

The purpose of this standard is to specify minimum competencies for those who will respond to hazardous materials incidents. It is not the intent of this standard to restrict any jurisdiction from exceeding these minimum requirements.

One purpose of the competencies contained herein is to reduce the numbers of accidents, injuries, and illnesses during response to hazardous materials incidents and to help prevent exposure to hazardous materials to reduce the possibility of fatalities, illness, and disabilities affecting emergency response personnel.

<table>
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<tr>
<th>NFPA 473 Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents</th>
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<td>This standard identifies the levels of competence required of emergency medical services (EMS) personnel who respond to hazardous materials incidents. It specifically covers the requirements for basic life support and advanced life support personnel in the prehospital setting.</td>
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<td>The purpose of this standard is to specify minimum requirements of competence and to enhance the safety and protection of response personnel and all components of the emergency medical services system. It is not the intent of this standard to restrict any jurisdiction from exceeding these minimum requirements.</td>
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<td><strong>NFPA 704 Standard</strong>  &lt;br&gt;<strong>System for the</strong>  &lt;br&gt;<strong>Identification of the</strong>  &lt;br&gt;<strong>Hazards of Materials for</strong>  &lt;br&gt;<strong>Emergency Response</strong></td>
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<td>NFPA 1001 Standard for Fire Fighter Professional Qualifications</td>
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<td><strong>NFPA 1500 Standard on Fire Department Occupational Safety and Health Program</strong></td>
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<td><strong>NFPA 1561 Standard on Fire Department Incident Management System</strong></td>
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Page 32 ©National Fire Protection Association • Fire Fighter Fatality-West Helena, Arkansas
personnel operating at an incident and for any and all other persons whose safety is affected by fire department operations. Risk management provides a basis for the following:
(a) Standard evaluation of the situation;
(b) Strategic decision-making;
(c) Tactical planning;
(d) Plan evaluation and revision;
(e) Operational command and control.

Many of the requirements of this standard could be satisfied by adopting a “model” system (such as the Incident Command System) that is intended to provide for a uniform approach to incident management while providing for some variations to meet local requirements.

An incident management system is intended to provide a standard approach to the management of emergency incidents. The primary objective is always to manage the incident, not to fully implement and utilize the incident management system. The command officer should be able to apply the incident management system in a manner that supports effective and efficient management of the incident. The use of the system should not create an additional challenge for the incident commander.
APPENDIX A- Fire Fighter Fatality Reports

The following are abstracts from other fire fighter fatality incidents investigated by NFPA. Copies of the full reports are available from NFPA’s Charles S. Morgan Library at 617-984-7445, or by email at library@nfpa.org.

Branford, CT

At approximately 4:30 p.m. on Thursday, November 28, 1996, a fire occurred in a Branford, Connecticut carpet store and warehouse. The fire started in the store's office area, damaged the ceiling assembly and ignited the building's wood roof trusses. Seven fire fighters were making the initial attack when the roof collapsed. Five of seven fighters were able to find their way out of the building. The sixth fire fighter was unconscious and had to be rescued, and the seventh died before he could escape.

The building was 60 ft (18.3 m) wide and 120 ft (36.5 m) long. It had wood-frame exterior bearing walls in one section and masonry block exterior bearing walls in all other areas. Lightweight wood trusses carried the store's roof over a clear span of 60 ft (18.3 m). The building did not have any fire detection or suppression systems.

The Branford fire fighters responded to a report of smoke coming from the roof of a carpet store and found light smoke showing near the roof eaves at the front of the building, upon arrival. On the basis of the observed conditions, the fire officers believed that the fire was located somewhere in the showroom area. Six fire fighters advanced two hoselines to the front of the building. Another Branford fire fighter entered the building without the knowledge of the incident commander and the officer in charge of interior operations bringing the total number of fire fighters in the building to seven.

The fire fighters found fire in a corner of a showroom and attempted to extinguish that fire. At approximately the same time, the incident commander who was outside of the building and the interior officer realized that there was fire above the fire fighters. The interior officer ordered every one out of the building and the incident commander radioed the interior crews also ordering them out. Before the fire fighters could leave the building, the roof collapsed. This was approximately 17 minutes after the fire fighters arrived on the scene.
Four fire fighters escaped out of the front of the building, and the officer and two fire fighters were trapped toward the center of the building. These fire fighters freed themselves from the debris and began spraying the burning rubble with a hoseline. The officer then told the two fire fighters that they would have to move to the rear of the building where two overhead doors were located. The officer and one fire fighter began moving toward the rear of the building and became separated from the other fire fighter.

Before reaching the door, the fire fighter who was with the officer ran out of air and collapsed. Unable to help the fire fighter, the officer continued on, found a door and left the building. Once outside, the officer could not get assistance from other fire fighters, so he reentered the building. The fire officer found the collapsed fire fighter even though the fire fighter had not turned on his PASS (Personal Alert Safety System) device. The officer dragged the fire fighter out of the building.

Once the incident commander learned that six fire fighters had escaped, he believed that everyone was out because he was not aware that a seventh fire fighter had entered the building. After a brief discussion of the events that had occurred, and the officers determined that one fire fighter had in fact, not escaped. The missing fire fighter was found approximately 20 ft (6 m) from the position where he was last seen by the officer. The cause of the fire fighter's death was listed as smoke inhalation.

On the basis of its investigation and analysis, the NFPA determined that the following factors contributed to the loss of the Branford fire fighter:

- Fire officers and fire fighters unaware that the roof of the Branford carpet store was constructed with lightweight wood trusses
- The ineffective use of an incident management system and no formal fire fighter accountability system
- The absence of a Rapid Intervention Crew (RIC)
- The lack of automatic sprinkler protection
Seattle, WA

A fire in a Seattle warehouse on January 5, 1995, resulted in the deaths of four members of the Seattle Fire Department. All four died when the floor between the upper and lower levels of the building collapsed. The fire, which was determined to have been set intentionally, began in the building's lower level directly below the area in which fire crews were conducting interior fire operations.

The building in which the fire occurred was originally constructed in 1909 with a structural support system of heavy timber. Over the years, however, the warehouse had been modified a number of times. One of these modifications was a cripple wall constructed of material estimated to be 2 inches by 4 inches in dimension, that had been installed to support the joists of the floor assembly between the upper and lower levels. Unfortunately, this cripple wall was more susceptible to fire than the building's other structural support mechanisms and when it failed it caused the floor to fail, creating the opening into which the four fire fighters fell.

As a result of NFPA's on-site investigation, which began the day after the collapse, and subsequent interviews, the following were identified as contributing factors in this incident:

- Confusion about the physical layout of the building, as well as the location of crews working in, above, and around the structure.
- Lack of awareness on the fireground of the location of the fire and the various crews in relation to the fire.
- Insufficient progress reports transmitted over the fireground frequency.
- Lack of awareness of the length of time the building had been on fire and the passage of time after fire department notification.
- Failure to take into account the fact that the building was a known arson target when formulating the fireground strategy.
- Insufficient information to develop a risk/benefit evaluation of fireground operations.

Over the past six years, the Seattle Fire Department has aggressively sought to enhance firefighter safety by instituting a personnel accountability system that has become the model for many other fire departments around the country and by equipping personnel with protective equipment that meets current standards and portable radios that allow
them to transmit an automatic, coded distress call to the dispatch center. Despite these precautions, four fire fighters lost their lives. As this incident so tragically illustrates, a great many dangers must still be accounted for during fire fighting operations.
Chesapeake, Virginia

At approximately 11:30 a.m. on Monday, March 18, 1996, fire fighters in Chesapeake, VA, responded to a fire in an auto parts store. No fire was visible from the exterior of the building when the fire fighters arrived. Two fire fighters entered the building and located a small fire at the rear of the store. The fire fighters extinguished the fire and began checking for fire extension. Approximately 20 minutes after their arrival, the roof of the building collapsed and the two fire fighters were trapped inside. The fire fighters both died of burns, with smoke inhalation being a contributory factor.

The building involved was approximately 12 years old. Two of the building’s exterior bearing walls were constructed with unprotected steel frames and two were constructed with masonry block. Lightweight wood trusses with a clear span of 50 ft (15.2 m) supported the store’s roof. Because the facility was an auto parts store, it contained a wide variety of combustible and noncombustible materials, flammable auto paints (liquid and aerosol), and other flammable and combustible liquids. Most packaging materials and some shelving materials were also combustible.

The fire occurred when a utility worker damaged the electrical service drop conductors on the outside of the store. Electrical arcing inside the store ignited fires that quickly involved the wood trusses supporting the roof and ignited a fire in the area of an electric hot water heater. Though some of the fire was visible to anyone in the occupied area of the building, much of the fire was hidden in the concealed space above the store's ceiling, and the fire was able to spread in that area.

The fire fighters who died in this fire probably did not know that the building was constructed with lightweight wood roof trusses. Approximately seven minutes after they had arrived on the scene, the crew inside the building radioed their battalion chief to report that they had found the fire. They asked for a second crew to come into the building and requested a pike pole. Approximately 13 minutes after this transmission, the roof collapsed, intensifying the fire and trapping the fire fighters inside the building. The trapped fire fighters radioed for assistance but, for an undetermined reason, the incident commander did not understand the transmission. Two other chief officers who were responding to the scene did hear the transmission and relayed the information to the on-scene commander. By the time the on-scene commander realized that fire fighters were possibly trapped inside the building, the fire had become too intense to attempt rescue operations.
On the basis of the NFPA's investigation and analysis of this fire, the following factors contributed significantly to the loss of the two Chesapeake fire fighters:

• The presence of lightweight wood roof trusses.

• Fire officers and fire fighters unaware that the roof of the Chesapeake auto parts store was constructed with lightweight wood trusses.

• The lack of a fire attack strategy that could minimize the risk to fire fighters while suppressing a fire involving lightweight wood trusses.

• The lack of automatic sprinklers.
Pittsburgh, PA

On Tuesday, February 14, 1995, a fire in a one-family dwelling resulted in the deaths of three Pittsburgh, PA fire fighters. Three other fire fighters were also injured.

The building involved was a three-story, wood-frame structure with a basement and was constructed on a sloping grade that caused the building to have a different appearance depending on the side being viewed. Fire fighters entering the building saw only one side and were not aware of the building's actual arrangement. The fire fighters' distorted perception of the building may have impaired their ability to assess alternate escape routes.

During interior fire fighting operations, the stairway used by fire fighters to enter a room collapsed. Sometime after that collapse, fire fighters outside the building realized that other fire fighters were trapped inside. Since fire fighters from several companies were working at the scene, fireground supervisors were not able to quickly assess which companies and individual fire fighters were working in the building. After several trapped fire fighters were rescued through an exterior window, a full accounting of all fire fighters was not performed. Unknown to the incident commander, three other injured fire fighters remained trapped in the building. These fire fighters were discovered after most of the fire had been extinguished and smoke had been removed from the building, about one hour and ten minutes after they originally entered.

Adherence to procedures that allow for quick accounting of fire fighters on the fireground and the use of rapid intervention teams are precautions that can reduce risks to fire fighters during structural collapse and other unplanned events that can threaten fire fighters during suppression operations. The importance of these precautions is evident in two NFPA documents, i.e., NFPA 1561, *Standard on Fire Department Incident Management System*, and NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*. Both have complete sections containing specific accountability requirements. In addition, NFPA 1500 contains requirements for rapid intervention crews.