U.S. Fire Administration/Technical Report Series

Six Firefighter Fatalities in Construction Site Explosion

Kansas City, Missouri

USFA-TR-024/November 1988

Homeland Security

U.S. Fire Administration Fire Investigations Program

The U.S. Fire Administration develops reports on selected major fires throughout the country. The fires usually involve multiple deaths or a large loss of property. But the primary criterion for deciding to do a report is whether it will result in significant "lessons learned." In some cases these lessons bring to light new knowledge about fire--the effect of building construction or contents, human behavior in fire, etc. In other cases, the lessons are not new but are serious enough to highlight once again, with yet another fire tragedy report. In some cases, special reports are developed to discuss events, drills, or new technologies which are of interest to the fire service.

The reports are sent to fire magazines and are distributed at National and Regional fire meetings. The International Association of Fire Chiefs assists the USFA in disseminating the findings throughout the fire service. On a continuing basis the reports are available on request from the USFA; announcements of their availability are published widely in fire journals and newsletters.

This body of work provides detailed information on the nature of the fire problem for policymakers who must decide on allocations of resources between fire and other pressing problems, and within the fire service to improve codes and code enforcement, training, public fire education, building technology, and other related areas.

The Fire Administration, which has no regulatory authority, sends an experienced fire investigator into a community after a major incident only after having conferred with the local fire authorities to insure that the assistance and presence of the USFA would be supportive and would in no way interfere with any review of the incident they are themselves conducting. The intent is not to arrive during the event or even immediately after, but rather after the dust settles, so that a complete and objective review of all the important aspects of the incident can be made. Local authorities review the USFA's report while it is in draft. The USFA investigator or team is available to local authorities should they wish to request technical assistance for their own investigation.

This report and its recommendations were developed by USFA staff and by TriData Corporation, its staff and consultants, who are under contract to assist the USFA in carrying out the Fire Reports Program.

USFA wishes to acknowledge the support and cooperation of the Regional Director and staff of FEMA's Region VII office in Kansas City and the Kansas City Authorities without whose permission and wholehearted cooperation this report would not have been written. In particular we wish to acknowledge the cooperation and assistance of Assistant Chief Manager Raymond E. Shipman, Chief Edward W. Wilson (Chief of Department), Chief Robert L. Wallace (Fire Marshal), and City Attorney Sam Mumma.

For additional copies of this report write to the U.S. Fire Administration, 16825 South Seton Avenue, Emmitsburg, Maryland 21727. The report is available on the Administration's Web site at http://www.usfa.dhs.gov/

Six Firefighter Fatalities in Construction Site Explosion Kansas City, Missouri

Investigated by: Jack Yates

This is Report 024 of the Major Fires Investigation Project conducted by TriData Corporation under contract EMW-88-C-2649 to the United States Fire Administration, Federal Emergency Management Agency.

Homeland Security

Department of Homeland Security
United States Fire Administration
National Fire Data Center

U.S. Fire Administration

Mission Statement

As an entity of the Department of Homeland Security, the mission of the USFA is to reduce life and economic losses due to fire and related emergencies, through leadership, advocacy, coordination, and support. We serve the Nation independently, in coordination with other Federal agencies, and in partnership with fire protection and emergency service communities. With a commitment to excellence, we provide public education, training, technology, and data initiatives.

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TABLE OF CONTENTS

Six Firefighter Fatalities in Construction Site Explosion
Kansas City, Missouri
November 29, 1988

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OVERVIEW

The Kansas City, Missouri Fire Department lost six firefighters and their vehicles – two entire pumper companies – in an explosion that occurred while they were extinguishing a fire at a construction site. The fire involved a trailer/magazine containing blasting mixtures of ammonium nitrate and fuel oil, most containing aluminum pellets, too. The fire also involved two other vehicles and ultimately a second trailer/magazine that also exploded. A summary of the incident's key issues is present in table form on the following pages.

The firefighters were not told specifically what was in the trailer/magazine, but had been cautioned by the dispatcher about explosives on the site. Exactly what they suspected was in the trailers will probably never be know.

The two captains and four firefighters involved were highly experienced. Four of the six had attended National Fire Academy (NFA) field courses on hazardous materials (Hazmat) identification. They also had Department of Transportation (DOT) Hazardous Materials Guidebooks in their vehicles.

However, the trailers/magazines containing the blasting agents probably had no markings or placards indicating their contents, and the crews may never have been sure of what was in them, especially since other, prominently marked magazines were present and may have been misconstrued to contain all the dangerous materials. The fire department was not aware of the presence of the trailers/magazines or their contents before the incident due to a lack of jurisdictional authority and because the city's Fire Prevention and Protection Code did not require the city engineer to notify the fire department that blasting permits had been issued. (This was immediately changed after the incident.) More importantly, the Kansas City Fire Department had no authority or responsibility to inspect the site because it was a State enclave.

Furthermore, it is not clear that if the personnel on the scene had known of the presence of the blasting agent (ammonium nitrate mixed with fuel oil), their Hazmat training or their use of the DOT Guidebook would have necessarily led them to behave differently than they did.

SUMMARY OF KEY ISSUES

Issue	Comments
Cause	Arson
Casualties	Six firefighters killed in explosion while fighting magazine/trailer fire.
Property Type	State of Missouri highway construction site with explosives in magazines and 50,000 lbs. of ammonium nitrate/fuel oil mixture (most with aluminum pellets) stored in two trailers/magazines.
Fire Department Awareness of Explosives on Site	Fire department had not been involved in blasting permit process and was unaware of explosives on the site prior to the incident. Nor did the department have jurisdictional authority over the site. Dispatcher was told of presence of explosives, but not what was stored, nor where.
Firefighters' Awareness of Explosives on Site	Both pumper companies were told of explosives on the site by the dispatcher, but nothing specific. Trailers/magazines probably were not placarded nor marked to indicate contents. They were not required by the Bureau of Alcohol, Tobacco and Firearms (ATF) to be marked when parked on site.
Firefighter Hazmat Training	Four of the six firefighters killed had taken NFA field Hazmat courses. Course materials do not appear to place sufficient emphasis on explosive hazard of fighting fires involving ammonium nitrate.
Emergency Response Guides	Format and sequence of DOT Guidebook may not be sufficiently clear in an operational environment. Material Safety Data Sheet (MSDS) clearly says flee this type of fire.
ATF Policy	While there is no official AFT policy against placarding, there appears to be a generally accepted practice in the field of removing placards when not in transit.
Jurisdictional Issues	State highway site is not under city control regarding permits or inspections, according to the city attorney. ATF has universal jurisdiction over explosives except during transportation, but does not ordinarily inspect or issue permits for sites. Local fire departments are almost always the first responder, have their personnel at risk, yet do not always have regulatory control or guaranteed coordination from other agencies.

THE INCIDENT

On November 29, 1988, an alarm was received at 0340 by the Kansas City, Missouri Fire Department indicating there was a fire at a highway construction project. The caller, a night guard at the site, initially stated that there was a "small pickup truck" burning. In the background a woman could be heard saying "the explosives are on fire." The woman was later identified as another guard.[1]

The caller went on to say "…there's a fire on both sides of the highway." Then, in response to the dispatcher asking "What's burning?" the caller said: "Uh, there may be some – there's some explosives up on a hill that I also see now is burning."

The dispatcher then directed Pumper 41 to respond to the pickup truck fire. He added: "Pumper 41, use caution on your call. There's information there may be explosives. It's in a construction area…" (Editor's underlining here and elsewhere in quotes.)

Pumper Company 41 was dispatched and, upon arriving at 0346, found that there were in fact two separate fires. It radioed dispatch at 0347 to send another pumper company.

When the second company, Pumper 30, arrived, at 0352, at the second fire, which was several hundred yards away, the first company called dispatch and stated that there seemed to be two arson fires and requested that the police be sent. The first-in company also asked dispatch to warn the second company of explosives.

"If you can get 30, tell them there's a trailer on fire up there, stay away from it … There's supposed to be explosives involved in this." This was at 0357, five minutes after the second company had arrived. Pumper 41 also asked that a battalion chief be sent "emergency."

At 0359, Pumper 30 asked the dispatcher, *"Can you confirm that there is explosives in this trailer or not?"* The dispatcher responded, *"Pumper 41 advised that, and we have additional information on the original call that there were explosives in that area, use caution."*

To recap, at this point, both units had been advised that there were explosives on the scene, and both had acknowledged this. But they had not been told specifically that the trailer was a magazine with explosives, nor what might be on the site. They gave no indication they had seen a placard, nor that they realized the "trailer" was a magazine, nor that they knew the contents. They also did not seem alarmed. The first company extinguished the fire in the pickup truck and proceeded to the other fire to assist the second company. A truck, a "trailer," and a compressor – three separate vehicles – were on fire at this time (about 0402). Pumper 41 also requested that a four-wheel drive squad be sent.

However, as indicated above, they appeared to have been aware that there might be explosives in the trailer.

At 0404, Pumper 41 called to Battalion Chief 107, who was en route to the scene: "Apparently this thing's already blowed up, Chief. He's got magnesium or something burning up here." (They may have been seeing sparks from the aluminum sides of the trailer burning.)

At 0408, approximately 22 minutes after the first pumper company arrived on the scene and approximately 16 minutes after the second company arrived on the scene a catastrophic explosion occurred. All six firefighters assigned to both companies were killed. The battalion chief and his driver who

[1]A transcript of the dispatcher's tape recording was prepared for this investigation by a court-qualified stenographer. Excepts are attached in Appendix A.

had just arrived and stopped about a quarter mile away received minor injuries. Their windshield was blown in.

After the first explosion, the battalion chief immediately pulled back and prevented other firefighters from entering the area. A command post was set up at a safe distance.

Approximately 40 minutes later, a second explosion occurred, followed by several minor explosions. The explosions broke windows far from the site and were heard through a wide area.

There were two large craters found where the two trailers had been. The first trailer explosion created a swimming pool-like crater, with a "deep part" 80 feet in diameter and eight feet deep connected to a smaller crater 20 feet in diameter and six feet deep. The second trailer explosion created a crater approximately 100 feet in diameter and eight feet deep. (See aerial photo in last Appendix.)

Information received from the Kansas City Fire Department is that the first explosion involved a trailer/magazine with a split load. One end had approximately 3,500 pounds of ammonium nitrate/fuel oil mixture. The remainder of the load was approximately 17,000 pounds of ammonium nitrate/fuel oil mix with 5 percent aluminum pellets. The second explosion was a trailer/magazine loaded with approximately 1,000 30-pound "socks" of ammonium nitrate/fuel oil mixture with 5 percent aluminum pellets.

THE CONSTRUCTION PROJECT SITE

The project under construction was the Bruce R. Watkins Memorial Drive; more specifically, an area near the intersection of U.S. Highway 71 and 87th Street in Kansas City, Missouri. (See Appendix B.) The highway project required the moving of substantial quantities of limestone that was routinely broken up by drilling holes into the rock, placing a blasting agent in the holes, and then detonating it. Kansas City has large quantities of limestone throughout the area, and there were in face several limestone quarry operations going on.

Professionals who deal with blasting have indicated that high explosives such as dynamite are too expensive to use as the routine blasting material. There also is greater instability with high explosives as opposed to blasting agents.

One of the most common blasting agents used throughout the United States is a mixture of ammonium nitrate with fuel oil. The common name for the product is ANFO, although it can be marketed under other names by individual manufacturers. If a more powerful explosive is needed, aluminum dust or pellets can be blended in. This creates a "hotter" load. Reportedly, of the approximately 50,500 pounds of ammonium nitrate/fuel oil mixture involved in these explosions, 47,000 pounds contained the mixture of 5 percent aluminum.

Personnel at the construction site indicated they used between 10,000 and 16,000 pounds a day on the average. The material came in 30-pound socks that were placed into the drilled holes, then detonated with a device such as a blasting cap.

The material was divided between two trailers/magazines less than 100 feet apart. There were no built-up berms or barriers between the trailers. Section 55.218, Table of Distances for Storage of Explosive Materials in the ATF Explosives Law and Regulation Handbook, states that with 25,000 to 30,000 pounds of explosives there must be a distance of 224 feet between trailers/magazines if unbarricaded.

The trailers/magazines were less than 600 feet from Highway 71 and less than 350 feet from 87th Street. There was a berm between the trailers/magazines and Highway 71. The minimal distance from Highway 71 should have been 933 feet.

There was not a berm between the trailers/magazines and 87th Street. Elevation of the land is such that the trailers/magazines were above most of the street. Traffic on this street is less than on Highway 71. If it was considered a class A to D highway, the minimal distance should have been 680 feet. National Fire Protection Association (NFPA) 495, Table of Distances for Storage of Explosives, generally agrees with the ATF Handbook distances. (See Appendix C.)

The Kansas City Office of the ATF described ANFO as one of the safest blasting materials in use. Its volatility comes about when it is enclosed or is in a "compressed area."[2] If it then ignites, it has substantial explosive capabilities. This may explain the delayed ignition of the second trailer. The stability of the ANFO may have kept it from exploding from a shockwave and flying debris, but tires and wooden parts of the trailer/magazine may have ignited, eventually causing the ensuing explosion.

The ammonium nitrate mixtures were stored in two appropriate "Type 5" trailers/magazines specifically designed to transport and store blasting agents. The trailers were in the open, not enclosed in any fencing. According to workers from the site, the trailers were not placarded when stored. As noted earlier, there is no evidence in the dispatcher tapes that the crews saw any placards or any other information on the trailers as to what they held.

Appendix N has a photograph of a typical Type 5 trailer/magazine from the same blasting agent manufacturer in use at another site in Kansas City at the time of the explosion. The permanently attached, foldable placards on the back of the trailer were in the "up" (covered) position. It is standard industry policy, according to the president of a blasting mixture company, to place placards down when the trailers leave the plant loaded, and to turn them up when they park on a site. Having placards covered or removed on site would not have been in violation of existing ATF regulations. The separation distances were in violation of ATF regulations. (See Appendix D for excerpts from the ATF regulations.)

Also on the site were two yellow high-explosive magazines used to store dynamite and blasting caps. (They appear in the aerial photo in the last Appendix.) It is possible that the crews on the scene saw these other magazines and thought they were the "explosives" referred to by the dispatcher. However, they did continue to question the contents of the trailer. One of the firefighter's bodies was found in the vicinity of one of these containers with a portable hand radio nearby. It is thought possible (but is again speculation) that he was scouting these magazines when the explosion occurred.[3]

CITY, STATE, AND FEDERAL CODES AND GUIDELINES

At the time of the explosion, Kansas City had adopted the Uniform Fire Code, 1982 Edition, for fire prevention and protection. Article III, Blasting, Section 14.33 Permit-Required, states that anyone doing any blasting within the city limits shall obtain a permit from the city engineer. (See Appendix E.)

All permits issued were under the Kansas City fire code, but there was nothing in the regulations requiring the City Engineer's Office to notify the Kansas City Fire Marshal's Office of any blasting

[2] A "compressed area" means a small, packed space like the cylindrical hole used in blasting.

[3] The condition of the deceased suggested that he was not near the trailer when it blew and was killed at a distance by the blast wave.

operations. Also, the permit application did not require specific information in regard to type, quantity, or site location of the explosives to be employed.

An additional jurisdictional problem appears to exist regarding "State Enclave" legislation. The City Attorney's Office rendered an opinion after this incident that, based on the provisions of Article IV, Section 29 of the Missouri Constitution and Section 227.030, RSMo (1986), the city has "no rights whatsoever" to enforce its code on State highway projects or their contractors (See Appendix F). The city should not issue permits or do any construction inspection or supervision on the projects. Thus, the City Fire Marshal's Office faces the dilemma between what it would like to do and what it can legally enforce. And the city engineer apparently did not have jurisdiction to issue the permit it did!

Since the explosion, the Kansas City Fire Marshal's Office has implemented changes that allow it to become cognizant of blasting material and blasting projects within their jurisdiction. All blasting permits now must be cleared through the Fire Marshal's Office, as well as the city engineer. Additionally, permit applications now require a more extensive description of the site project, the material being used, how it is stored, and a plot diagram showing storage locations (see Appendix G). Hazmat permits already were being registered in the Kansas City Alarm Office. Unusual conditions within structures (e.g., wild animals, people with physical impairments, and Hazmat) have long been maintained in a computer file there.

ATF – The role of ATF with respect to codes and enforcement is described in their explosives law and regulation handbook, ATF P 5400.7 (11/82). ATF oversees the manufacturing of explosives and the licensing of any user of explosives. They have the authority to regulate and inspect at all times. However, they seldom are able to inspect all user locations simply because of staffing shortages and the mobility of user sites. Many inspections are done in response to reported compliance failures or other reported incidents.

Because they have not been provided with adequate resources, ATF has little choice but to adopt a passive approach to enforcing their regulations, placing the burden of compliance on affected individuals or organizations.

Under Section 843(b)(5) of the ATF handbook, user applicants must demonstrate and certify in writing that they are familiar with State laws and local ordinances relating to explosive materials for the location in which they intend to do business. ATF is not under any obligation to inform the fire marshal or fire department about any explosive material over which they have regulatory power. ATF does not issue site specific permits or licenses; rather, the license is issued to the user. Local code does not supersede ATF guidelines, though the ATF handbook implies that users should comply with local codes. (See Appendix D.)

LABELING AND CODING OF STORAGE FACILITIES FOR EXPLOSIVES AND BLASTING AGENTS

One special codes and enforcement issue pertinent to this incident was the requirement – or lack of requirement – for labeling the trailers/magazines.

There are three classes of explosive material: high explosives (for example, dynamite); low explosives (for example, fuse lighters); and blasting agents (for example, ammonium nitrate/fuel oil mixture). The class of explosive dictates the type of magazine in which it is to be stored according to ATF guidelines. Types 1, 2, and 3 are magazines for high explosives. Type 4 is for low explosives. These four types of magazines are normally of smaller, heavier construction and brightly colored.

Type 5 magazines are for blasting agents and were in use on this site and involved in the two explosions. Blasting agents are typically stored in large quantities and are delivered in mobile Type 5 magazines which usually are owned by the manufacturers of the material (as in this incident) and have the appearance of a standard freight trailer. It may be a single or double axle trailer, depending on the load amount. (See Appendix H for Type 5 magazine storage requirements and construction exhibits.)

While the blasting agent is en route from the manufacturer to the user site, it is subject to regulation by the U.S. DOT. DOT regulations state that the vehicle must be placarded for identification purposes. This is the only time the explosive material is not directly under ATF jurisdiction. Once the Type 5 mobile magazine is parked, it is again under the jurisdiction of ATF. At this point the DOT placards usually are removed (or folded up), creating the problem of identification of contents.

The logic behind ATF's not requiring labeling of Type 5 magazines when parked is that they are less susceptible to theft and vandalism if they are not readily identified. By appearing as innocuous trailers, fewer people know what they contain. Unfortunately, as tragically illustrated here, this lack of knowledge also applies to firefighters.

One reason for this orientation toward confidentiality is that the ATF's regulations and the act that requires them were prompted primarily by the nationwide concern in the early 1970's over domestic terrorism.

Thus, while not officially opposed to placarding on site, the AFT regulations do not require them and do not address the issue. Furthermore, the removal of placards from trailers/magazines upon arrival on site appears to be accepted practice in the field.

The NFPA standard for "Manufacture, Transportation, and Storage of Explosive Materials – 1985" (NFPA 495) requires in Section 6-4,6 that "the local fire department … be notified of the location of all magazines …" The standard also requires in Section 6-85 that the property on which "Type 1 and outdoor Types 2, 4, and 5 are located be posted with signs reading 'Explosives – Keep Off'." The standard does not, however, require placarding or marking of the Type 5 magazines themselves or identification of the explosives. (See Appendix I.)

FIREFIGHTER HAZMAT TRAINING

Four of the six firefighters involved in this explosion, including both company officers, had received some exposure to Hazmat training through NFA field courses. Four had completed the NFA course, "Recognizing and Identifying Hazardous Materials."

The stated scope of this course is "to develop and basic skills with which to identify hazardous materials problem in their communities, to recognize hazardous materials presence, and to identify the specific hazardous material(s) and associated hazard characteristics." (See Appendix J for excerpts from NFA courses.)

The course stresses firefighter safety in Hazmat incidents. The acronym "D.E.C.I.D.E." is used repeatedly throughout the course text to guide the student through the emergency intervention process and to minimize personal risk. It stands for "Detect hazardous material presence; Estimate likely harm (without intervention); Choose response objectives; Identify action options; Do the best option; and Evaluate process." There are protective measures discussed throughout the course, all advising to continually exercise caution.

Much material in this course deals with problems encountered with transportation, such as accidents or leakage problems from vessels or tankers. In most of these instances, the Hazmat are identified through DOT placards. The first chapter of the course addresses the many types of Hazmat that can be expected. In the slide/tape script section, on slide #1036, blasting agents are described as being "so stable that there is little chance of an accidental explosion." While this may be taken to mean explosion from physical handling, the possibility of explosion from a fire needs to be added in view of this incident. This and the DOT Guidebook's reference material need to be brought into agreement with the MSDS information (discussed further below).

One of the two company officers and one firefighter who had taken the Identification course also had taken a second NFA field course, "Hazardous Material Incident Analysis." The basic outline of this course parallels the previously mentioned course but goes into greater detail regarding detection, intervention, and Hazmat behavior. Throughout the course, safety is emphasized. The second chapter poses the question, "What is the mission of your organization?" The suggested response is to protect life and property and do this safely. This theme is repeated throughout the text.

However, on page I-10, slide #24 description, ammonium nitrate/fuel oil mixture is described as "so insensitive that there is very little probability of accidental explosion." But six pages later, page I-16, slide #82, ironically depicts a scenario in which an unmarked trailer containing 26,000 pounds of blasting agent exploded in a fire, killing six firefighters and destroying their apparatus – similar in several aspects to the Kansas City incident.[4] Both Hazmat courses downplay the potential explosiveness of the type of blasting agent involved in this incident. This impression needs to be corrected.

Both courses primarily address situations where Hazmat are being transported and the materials are placarded or identified through bills of lading. The matter of shipping/transporting Hazmat is indeed a major area of concern and an appropriate focus; but the dangers presented by lack of information on storage sites also need to be discussed in the classes, especially in light of the Kansas City incident. There were no indications that a means of identification such as fencing or signs was present at the Kansas City incident. Lack of such warning multiples the potential danger associated with fire response involving blasting material.

ANALYSIS OF THE AWARENESS OF THE CREWS AS TO THE DANGER

As noted earlier, we will never know the entire picture regarding what the crews on the scene knew and thought about the hazard they faced. We do know from the dispatch tapes that they were aware of explosives on the site. We also know that the guards did not tell the dispatcher what materials were stored, nor where they were stored, and the dispatcher never asked them for this information. While it is clear from the tapes (see Appendix A) that they thought there might be explosives in the trailer, we can only speculate about their decision to fight the fire.

The two trailers were less than 100 feet apart. If either captain was familiar with distancing tables as set out in the ATF regulations, he may have assumed the contents were standard construction materials, as the distance requirements for explosives were not met. The lack of placarding or any special markings on the trailers may have added to the notion that they did not contain explosives.

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[4] The scenario describes a truck driver in Marshall's Creek, Pennsylvania, who noticed a tire fire on his vehicle. He removed the placards and then notified the fire department. Firefighters, upon their arrival, could not find the driver or see any indications of the trailer's contents. While attempting to extinguish the fire, the contents – 13 tons of blasting agent – exploded, killing "six firefighters." (The incident actually had three civilian and three firefighter fatalities.) This slide also is used in the Hazmat Identification course (Slide 1036).

Pumper 30, the second company to arrive at the construction site, was assigned to the area where the explosive material was stored. After notifying dispatch of their arrival, there was an almost five minute gap before their next transmission. This was enough time for Pumper 30 to have crossed into the construction area, driven on the back access road, seen the bright yellow high and low explosive magazines, and returned to the equipment fire. Both companies may have assumed they had located and isolated the explosives and felt safe in suppressing the equipment and trailer fires. But to repeat, this is speculation.

The body of the driver for Pumper 30 was found southeast of the explosion. A hand radio was found nearby. It is the driver's normal duty to stay with the equipment to operate the pumper. For him to be away from his normal duty position in the direction of the high explosive magazines and carrying a radio may also suggest he was further scouting the area for Hazmat. But again, this is speculation.

It is *known* that both captains had many years of firefighting experience and both had completed the field course from the NFA "Recognizing and Identifying Hazardous Materials."

Additionally, the captain and driver on Pumper 30 had taken the "Hazardous Materials Incident Analysis" course. The theory advanced by some after this fire that the problem was that not enough firefighters have Hazmat training would not seem to apply here. The two captains had been trained in recognizing Hazmat.

All information here points to the conclusion that they did not know what was in the trailers. And if they did know, based on either knowledge of local blasting operations or even a placard, they may still not have appreciated the great hazard they faced. Their courses, the information contained in the DOT Guidebook, and the information available to them about the site together still may not have been sufficient to allow them to recognize the magnitude of the hazard.

EMERGENCY RESPONSE GUIDEBOOK (DOT P 5800.4) AND MATERIAL SAFETY DATA SHEETS

Pumper companies in Kansas City carry the 1987 edition of the DOT Emergency Response Guidebook. A Guidebook was found lying in the demolished cab of one of the pumpers. The four firefighters who had taken Hazmat courses could have been expected to be familiar with the reference material in the DOT guide.

There are 15 variations of ammonium nitrate listed in the DOT Guidebook. Next to each type of material is a guide number that leads to information on the potential hazard and the appropriate emergency response. Each variation of ammonium nitrate also has a Hazmat identification number *with the sole exception of ammonium nitrate-fuel oil mixtures*. In all other uses or variations ammonium nitrate is listed as a Hazmat but when mixed with fuel oil it is listed as a blasting agent. There is no referral to ammonium nitrate/fuel oil as a Hazmat. (See Appendix K for excerpts from the DOT Guidebook.)

Blasting agents are assigned Guide Number 46 for the proper procedure in handling any potential emergency or hazard. The guide states this material may explode and throw fragments one-third of a mile or more if fire reaches the cargo area. The guide directs responders *not* to fight fire in the cargo and to try to prevent a fire from reaching the explosive cargo compartment. The guide also provides a subheading that describes the action to be taken for "Truck and Equipment Fires." It says to flood them with water, or if no water is available, to use Halon, dry chemical, or dirt.

Under the next subheading, "Cargo Fires," directions given are not to move the cargo or vehicle if the cargo has been exposed to heat and not to fight the fire when it reaches the cargo. The instructions given are to withdraw from the area and let the fire burn.

The possible confusion here to a firefighter using the book in an emergency is in the labeling and sequence of the headings. The bold type addresses "Truck and Equipment Fires" and "Cargo Fires." A pumper company arriving on a scene at 0340 hours and finding a trailer normally pulled by a truck along with construction equipment on fire may have a tendency to read the action to be taken under the first heading for "Truck and Equipment Fires," i.e., flood with water or, put simply, to fight the fire.

The MSDS for ammonium nitrate addresses the issue differently. (See Appendix L.) Under "Special Fire Fighting Procedures" it simply states, "*Fires involving explosive materials should not be fought.*" It further instructs to "Evaluate personnel at a safe location upwind of the fire. Burning material may produce toxic vapors." All suggested procedures are, of course, contingent upon the materials involved being identified.

LESSONS LEARNED

1. **Dispatchers need to seek and transmit the type, location, and amount of Hazmat present as early as possible.**

   The importance of obtaining details on the Hazmat known to be present at the time an alarm is called in cannot be overstated. This was addressed in the Kansas City Hazmat Standard Operating Procedures (SOP), item #5. (See Appendix M.) The dispatcher needs to query the caller and ask for specifics. In this incident the dispatcher did ask what was burning, but did not receive a complete answer. It was not determined whether the night guards had any further details, but callers should be probed further in such a situation when feasible.

   Guards and any other personnel likely to be first to report a fire should be informed about Hazmat they are guarding and instructed to volunteer that information to the fire department in an emergency. This guidance should be passed on to local industry.

2. **Incident command procedures to be used in the face of unknown risks should be spelled out, especially for situations where there is no threat to civilian lives.**

   The evaluation of the scene and the actions taken by the first officer at a fire or Hazmat incident are critical. The Kansas City Hazmat SOP, item #6, covers this. Emphasis should be placed on responses to industrial or construction sites where any type of enclosed structure is involved. Simply stated, if a container or building is on fire at these sites and the contents are not known, and there is no immediate threat to life or significant property, consideration should be given to evacuating the area. Emergency personnel should be drawn back to a safe distance, out of the line of sight and upwind.

   Pre-fire plans can provide a great deal of information about the risks at-hand during an incident. Many departments relay this information to responding units via the dispatcher or in-vehicle telemetry. Ironically, Kansas City was one of the first and best known communities to have a computerized file listing unusual risks in occupancies throughout the city. Unfortunately, enclaves render such a system useless.

3. Local means of improving identification of parked or stored blasting agents should be considered.

The current ATF Explosives Law and Regulation Handbook does not address the issue of outside container identification. While awaiting potential changes in Federal guidelines from DOT, ATF or other agencies, local governments should consider what they might do in the interim. One simple solution would be to require placarding of magazines on site.

If there is local concern about having placards affixed to the magazines (to keep contents confidential and reduce possibility of theft or vandalism), there are other alternatives. One alternative is to provide a numerical code or symbol that is less obvious.

Another approach is to encourage or require installation of chain link fences around the mobile/portable magazines. The Type 5 mobile magazines involved in this explosion were, in essence, freight trailers that had been hauled to the user site. A chain link fence with gates at two ends of a four-sided parking area would allow vehicles to pull through. (See photograph in last Appendix, taken at another Kansas City site.)

Kansas City has already made changes on its own, and now requires the City Engineer's Office to advise the Fire Marshal's Office of any application for blasting. They have developed a document that identifies the quantity and type of explosive material, the type of storage facility, and requires a copy of the MSDS sheet. Kansas City additionally has the applicant prepare a plot diagram showing Hazmat locations. These documents are to be made a part of the material in the responding fire companies' handbooks.

4. Fire departments should review local procedures for regulating Hazmat.

Kansas City was already aware of the jurisdictional problems involving State/Federal enclaves within their city limits. The city had to make changes in local administrative procedures to gain information about explosive materials on all types of sites. If these problems existed in Kansas City, no doubt they exist elsewhere.

5. Users of blasting materials should consider reducing amounts of explosives and blasting agents kept on site.

The Kansas City construction site was only about one hour's drive from the manufacturer of the blasting agent, yet a three to five day supply of blasting agent was kept on site. Tradeoffs among frequency of resupply, road exposure, site exposure and costs should be considered to arrive at an optimum method of supply for a project.

6. The NFPA Technical Committee on Explosives should review its requirements regarding marking of magazines.

The firefighters in this incident knew there were explosives on the site. NFPA 495 would have required the site to have a sign saying "Explosives … Keep Off" and to have notified the fire department about the location of explosives, but not to have the magazines marked. Reconsideration is needed of the dangers of more explicit marking of contents and location versus the hazard to firefighters.

RECOMMENDATIONS FOR FEDERAL ACTION

It is the opinion of the USFA that the tragic incident in Kansas City is in part the result of incomplete or unclear information. The immediate local issues and possible corrective actions (some of which have already been implemented by local authorities) have been discussed earlier.

What is more disturbing is the observation made in the report concerning the DOT Hazmat Guide and the NFA Field Training Courses. There exists the possibility that even if the two trailers/magazines had been placarded, or the two officers on the scene had otherwise been aware of the contents of the burning trailer/magazine, they may not have adopted a different course of action.

The difficulty is not that the material in either the DOT Guide or the courses is incorrect or that an appropriate course of action cannot be deduced from them. The difficulty is that the correct course of action is not unmistakably clear.

In the case of the training courses the single reference to an incident similar to the Kansas City explosion is offset by repeated references to the inherent stability of blasting agents in general and ammonium nitrate in particular. It is not clear that the residual impression left with even an attentive student would lead to a decision to evacuate and not fight the fire.

In the case of the DOT Guide the clear warning given at the top of the relevant section is offset by the detailed discussion further down the page of truck and equipment fires (see Guide 46, Appendix K). There is a similar potential area of confusion regarding ammonium perchlorate (which was the material involved in the 1988 Henderson, Nevada, chemical plant explosion). The guide indicates that if the material is in particle form, 45 microns or smaller, evacuation is called for. If larger than 45 microns the fire can be fought with protective clothing (by implication, Hazmat suits will protect against toxic off gases). Given the absence of any requirement for placarding it is not clear how firefighters would be able to make this distinction. (In any case the material that exploded in Henderson was reported to have been 90 microns or lagers, implying that there may be other problems with this particular set of guidelines.)

The principal point is that *educational materials, field guides for operations, and regulations governing Hazmat and particularly explosives need to be developed with the immediate problems and operational environment of the emergency response personnel as a primary focus.* Absolute clarity regarding worst case consequences is essential. These materials are being developed to guide the actions of emergency personnel whose natural tendency in the case of firefighters is, not surprisingly, to fight fire. To assert that when in doubt evacuation is the most prudent course of action is to overlook the nature of the profession of firefighting. Entering a burning building is an inherently dangerous act. In developing guidance for personnel who are accustomed by training and experience to take significant risks as a matter of course, absolute clarity and accuracy are essential.

Therefore, the USFA recommends that a general review of pertinent Federal regulations governing the manufacture, storage and handling of explosives (and Hazmat); Federally-sponsored training materials for first responders; and, Federally-developed field operations guides be undertaken by the responsible agencies. The object of such a review is to ensure that emergency response personnel who find themselves on the scene of an incident at three o'clock in the morning have as clear a picture as possible of the situation confronting them and the actions which they may not prudently take to protect lives and property.

Federal Emergency Management Agency
United States Fire Administration
Emmitsburg, Maryland 21727

May 10, 1989

Dear Editor:

I am happy to report that action is being taken here in Washington following the tragic Kansas City construction fire and explosion, which hopefully will decrease the chance of firefighters dying again in similiar circumstances. Details are presented in the attached brief article for your use.

Sincerely yours,

John Hart

John Hart
Assistant Administrator

FEDERAL AGENCIES ACT FOLLOWING KANSAS CITY EXPLOSION

Federal agencies are taking action as a direct response to the tragic construction site explosion that killed six Kansas City firefighters.

Lessons learned from the incident, together with recommendations for improving placarding, training, and other safety practices, were published by the USFA. With the full cooperation of Chief Edward Wilson of the Kansas City Fire Department and other city officials, USFA's Fire Investigations Program team spent three days on site and prepared the report "Six Firefighter Fatalities in Construction Site Explosion, Kansas City, Missouri, November 1988" which USFA has distributed widely to the fire community. (Copies are available on request from USFA.)

The U.S. Treasury Department's Bureau of Alcohol, Tobacco and Firearms, (ATF) has also taken action. Quoting from a recent letter from ATF Director Stephen E. Higgins to Clyde Bragdon, U.S. Fire Administrator:

> "ATF shares your concern for the tragic loss of life suffered by the firefighters responding to this emergency and is committed to working with all parties to minimize possibilities of future incidents.
>
> "ATF has the responsibility of regulating persons engaged in business involving explosives in interstate or foreign commerce and of reducing the hazard to persons and property arising from misuse and unsafe or insecure storage of explosive materials. Accordingly, ATF administers a system of licenses and permits, required records and reports, and sets construction and location standards for explosive material storage based on the quantity and class of the material to be stored.
>
> "ATF recognizes that vehicles used for transporting and storing blasting agents are not easily identifiable as magazines and ATF supports leaving the Department of Transportation placards (identifying the contents of the mobile unit) exposed to view as long as the vehicle contains any blasting agent material. ATF will incorporate such a requirement into the regulations governing storage.
>
> "ATF has already, through its representative on the National Fire Protection Association (NFPA) Technical Committee for standard NFPA 495, supported the committee comment to include a provision that placards be left in place on vehicles storing blasting agents.
>
> "Further, ATF will work with State fire officials to identify a single office in each State which will be responsible for disseminating periodic ATF provided lists of Federal licensees and permittees to the local fire agencies having jurisdiction over the various cities and counties.
>
> "Finally, ATF will investigate any referrals received from State or local officials regarding possible illegal storage of explosives."

The USFA is pleased with the response of the ATF, and Director Higgins is to be commended for these actions. To obtain a copy of USFA's report, write Fire Investigations Program, USFA, 16825 South Seton Avenue, Emmitsburg, Maryland 21727.