United States Fire Administration

Technical Report Series

Six Firefighter Fatalities in Construction Site Explosion Kansas City, Missouri

Federal Emergency Management Agency

United States Fire Administration

National Fire Data Center

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.

The reports are sent to fire magazines and are distributed at national and regional fire meetings. The International Association of Fire Chiefs assists USFA in disseminating the findings throughout the fire service. On a continuing basis the reports are available on request from USFA.

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 USFA's assistance and presence would be supportive and 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 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 Fire Administration 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 of 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 City Manager Raymond E. Shipman, Chief Edward. W. Wilson (Chief of Department), Chief Robert L. Wallace (Fire Marshall), and City Attorney Sam Mumma.

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

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.

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Kansas City, Missouri
November 29, 1988

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Six Firefighter Fatalities in Construction Site Explosion

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 known.

The two captains and four firefighters involved were highly experienced. Four of the six had attended National Fire Academy field courses on hazardous material identification. They also had 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 hazardous materials 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 ATF to be marked when parked on site.

SUMMARY OF KEY ISSUES Cont'd

Issues	Comments
Firefighter HazMat Training	Four of the six firefighters killed had taken National Fire Academy 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 ATF 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 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.'

The caller went on to say 'I... 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

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

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 appear 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 fire-fighters assigned to both companies were killed. The battalion chief and his driver who 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 fact 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. 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 Bureau of Alcohol, Tobacco and Firearms (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.

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

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.)

[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.

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 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). Hazardous material permits already were being registered in the Kansas City alarm office. Unusual conditions within structures (e.g., wild animals, people with physical impairments, and hazardous materials) have long been maintained in a computer file there.

ATF -- The role of the Bureau of Alcohol, Tobacco and Firearms (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 manpower

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. Department of Transportation (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 ATF 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 an accepted practice in the field.

The National Fire Protection Association 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 HAZARDOUS MATERIAL TRAINING

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

The stated scope of this course is "to develop the 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 National Fire Academy courses.)

The course stresses firefighter safety in hazardous material 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 hazardous materials are identified through DOT placards. The first chapter of the course addresses the many types of hazardous materials 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 Material Safety Data Sheet (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 National Academy 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 hazardous material 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 hazardous material 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 hazardous materials are being transported and the materials are placarded or identified through bills of lading. The matter of shipping/transporting hazardous materials 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 multiplies the potential danger associated with fire response involving blasting material.

[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 Haz Mat Identification course (Slide 1036).

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.

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 hazardous material. 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 National Fire Academy for "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 hazardous material training would not seem to apply here. The two captains had been trained in recognizing hazardous materials.

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 hazardous material 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 hazardous material ID number <u>with the sole exception of ammonium nitrate-fuel oil mixtures.</u> In all other uses or variations ammonium nitrate is listed as a hazardous material but when mixed with fuel oil it is listed as a blasting agent. There is no referral to ammonium nitrate/fuel oil as a hazardous material. (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 Material Safety Data Sheet (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 "Evacuate personnel to 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 hazardous materials present as early as possible.

The importance of obtaining details on the hazardous materials known to be present at the time an alarm is called in cannot be overstated. This was addressed in the Kansas City Hazardous Material 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 hazardous material 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 hazardous material incident are critical. The Kansas City Hazardous Material 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 hazardous material 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 hazardous materials.

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 United States Fire Administration 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 Haz Mat Guide and the National Fire Academy 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 potentia 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, hazardous materials 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 larger, implying that there may be other problems with this particular set of guidelines.)

The principal point is that <u>educational materials, field guides for operations, and regulations governing Hazardous Materials and particularly explosives need to be developed with the immediate problems and operational environment of the emergency response personnel as a primary focus.</u> 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 fire fighting. 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 United States Fire Administration recommends that a general review of pertinent federal regulations governing the manufacture, storage and handling of explosives (and hazardous materials); 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 most 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 U. S. Fire Administration. 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 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 support; 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 U. S. Fire Administration 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, U. S. Fire Administration, 16825 S. Seton Avenue, Emmitsburg, Maryland 21727.

United States Fire Administration

Technical Report Series

Six Firefighter Fatalities in Construction Site Explosion Kansas City, Missouri

Appendices

Federal Emergency Management Agency

United States Fire Administration

National Fire Data Center

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

Appendices

This is Report 024 of the Major Fires Investigation Project conducted by TrlData Corporation under contract EMW-88-C-2849 to the United States Fire Administration, Federal Emergency Management Agency.

Federal Emergency Management Agency

United States Fire Administration

National Fire Data Center

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.

The reports are sent to fire magazines and are distributed at national and regional fire meetings. The International Association of Fire Chiefs assists USFA in disseminating the findings throughout the fire service. On a continuing basis the reports are available on request from USFA.

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 USFA's assistance and presence would be supportive and 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 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 Fire Administration 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 of 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 City Manager Raymond E. Shipman, Chief Edward. W. Wilson (Chief of Department), Chief Robert L. Wallace (Fire Marshall), and City Attorney Sam Mumma.

Appendices

A. Transcript of Kansas City Dispatcher Tape.

B. Sketch of explosion and construction site, based on diagram prepared by the Kansas City Police Department Bomb and Arson Squad.

C. Tables of Separation distances for Blasting Agents

D. Excerpts from ATF Handbook on Explosives and Blasting Agents.

E. Kansas City Code for Fire Prevention and Protection regarding requirements for blasting permits at time of explosion.

Kansas City Uniform Fire Code for Explosives and Blasting Agents and Hazardous Material.

Permit used by City of Kansas City at time of explosion.

F. Kansas City Attorney's Opinion regarding permits and inspections.

G. Kansas City blasting permit job site description, plot diagram and approval form.

H. Type 5 magazine storage requirements and construction exhibits.

I. Excerpt from NFPA 495.

J. Excerpts from National Fire Academy Courses.

K. Excerpts from 1987 DOT Emergency Response Guidebook.

L. Material Safety Data Sheet on ammonium nitrate/fuel oil mixture.

M. Hazardous material SOP for Kansas City, Missouri, at time of explosion.

N. List of slides/photographs.

Appendix A

Transcript of Kansas City Dispatcher Tape

December 15, 1988.

Fire Department

Fire Alarm and Communications

414 E. 22nd

Kansas City, Missouri 64108

Fire Explosion Transcript

The following is a transcript of the recording made during the explosion incident, Alarm #15572 on November 29, 1988. For convenience, "D" indicates dispatcher; "C" caller; "LS" Lee's Summit: "R" Raytown; "IF" Independence Fire; "NC" Northwest Cass; "JCK" Johnson County, Kansas: "CJ" Central Jack; "E" Eagle.

340:57

(D) Fire department.

(C) Yes, I want to report a fire.

(D) Where abouts?

(C) It's on 71 Highway in the southbound lane.

(D) Okay, what's burning?

(C) A truck.

(D) Big truck; small truck?

(C) A small pickup truck.

(D) Where abouts on 71?

(L) (Lady in background of caller) The explosives are on fire.

(D) Can you give me an intersection?

(C) Yeah, there's a fire on both sides of the highway. It's on 87th Street.

(D) 87th and 71? What's burning?

(C) Uh, there may be some -- uh, there's some explosives up on a hill that I also see now is burning.

(D) Okay; we'll have units there. Thank you.

(C) Uh-huh.

(214) 214 on the scene.

0342:19 Still Alarm

(D) Pumper 41. There is a pickup truck at -- south

of Blue River and 71 Highway on the west side. Pumper 41, reported to be a pickup truck on Blue -- just south of Blue River and 71 Highway on the west side. Pumper 41, use caution on your call. There's information there may be explosives . It's in a construction area. The pickup truck may be in that area.

(18) Pumper 18.

(D) Received.

(18) We've got a car on fire at 2907 Linwood.

(D) Where at Linwood?

(18) 31st and Indiana.

(D) 10-4. We have a 3-l at Benton. Go ahead and make the call.

(18) 10-4.

0343:56

(41) 41 Clear.

(D) 41 Clear. Pumper 11, make 18s fill-in for 8s station. Pumper 11, make the fill in at 8s station.

0344:15

(18) Pumper 18, 10-97 using one small on automobile.

(D) Pumper 18, 10-97 using one small on an

automobile.

(32) Pumper 32 is clear.

(D) 32 is clear.

(19) 19 station clear.

(D) 19 is clear.

(40) Pumper 40 is clear.

(D) Pumper 9 fill 10s. 10-4

(40) Pumper 40 is clear.

(D) 40 pumper is clear. 10-4.

0344:06

(19) Pumper 19 is clear.

(D) 10-4.

(32) Pumper 32.

0346:41

(41) Pumper 41, 10-97.

(D) 41 on the scene.

(5) Open Pumper 5s door, please.

0347:28

(41) Pumper 41 to dispatcher.

(D) Pumper 41.

(41) We have two fires down here. One west of Blue River and one east of Blue River. You better get

another pumper company down here.

(D) Message received.

0347:43 Still Alarm

0347:45

(D) Pumper 30 went on to call Pumper 41 in the vicinity of Blue River and 71 Highway. Pumper 30 with Pumper 41 make the call in the vicinity of Blue River and 71 Highway. Check with Pumper 41 when you get in the area.

(11) 11 Pumper's clear.

(D) 11 Clear.

(9) Open 9s station or 9s door.

Open 9s and 6s truck door.

0350:19

(30) 30 Pumper's clear.

(D) 30 clear.

(23) Open 23 Pumper's door, please.

0352:58

(30) 30 Pumper 10-97.

(D) 30 on the seen.

(25) Open 25s door.

(D) 10-4. Pumper 40.

(17) Pumper 17 is in service.

(D) 17 in service.

(17) This is 17. Do you still want us to move to 10s?

(D) Stand by. Pumper 11, what's your location?

(11) Pumper 11, Truman Road and Harrison.

(D) 10-4. Going to 8s, Pumper 11. Pumper 17, for the time being return to your station.

(17) 10-4.

0357: 20

(41) 41 to dispatcher.

(D) 41.

(41) It appears to be two arson fires out here. Send the police.

(D) 10-4. Is that on vehicles?

(41) 10-4 -- uh, 41 to 30s Pumper. 41 to 30s Pumper.

0357:58

(41) 41 to dispatcher.

(D) 41.

(41) If you can get 30, tell them that there's a trailer on fire up there, stay away from it, and we better have 107 out here. There's supposed to be explosives involved in this.

(D) Pumper 30.

(30) Pumper 30, 10-4.

(D) Do you want 107 emergency?

(41) Yeah, you can send him emergency.

0358:24 Still Alarm

(D) Car 107 make the alarm. The companies are just south of Blue River and 71 Highway. Pumper 41's on the west side. 107 make the alarm. It's just south of Blue River and 71 Highway on the west side.

(8) 8 Pumper's door, please.

(D) 10-4.

0359:31

(30) Pumper 30 to dispatcher.

(D) 30.

(30) Can you confirm that there is explosives in this trailer or not?

(D) Pumper 41 advised that and we have additional information on the original call that there were explosives in that area, use caution.

(30) Pumper 30, 10-4. Send 41s up here when they're here.

(D) 41, did you copy 30s message?

(41) 41, 10-4; we're in route now.

(D) 10-4.

(18) Pumper 18 in service.

(D) 10-4.

(10) Open Pumper 10s door.

(D) 10-4.

(18) Pumper 18s door.

(D) 10-4.

(211) 211 on the scene.

(D) 211 on the scene.

D KAB 9564 400.

Dispatcher, open 12s Quint door.

(D) 10-4. Quint 38.

(17) Raise 17s door, please.

(41) 41 to dispatcher. 41 to 107.

0402:13

(107) 107.

(41) The way it looks right now we're going to have to haul some water up in here with a squad or something. We've got a trailer and one of the compressors going up here.

(107) You need a four-wheel drive back in there?

(41) Yeah, you can get a four-wheel drive back in here.

(107) 107 to dispatcher.

(D) 107.

(107) Did you read 41's needing a four-wheel drive squad in there?

(D) Message received.

(201) 201 is on the scene.

(D) 201 on the scene.

(101) Car 101.

0404:20

(107) 107 to Pumper 41.

0404:26 Still Alarm

(D) Squad 42 with the four-wheel drive responding to just south of Blue River and 71 Highway to meet the companies.

(41) 41 to 107.

(107) Yeah, are you on the east side or the west side, Jim?

(41) East side.

(107) 10-4.

(41) 41 to 107.

(107) 107.

(41) Apparently this thing's already blowed up, Chief. He's got magnesium or something burning up here.

(107) 10-4. Are you back up in there now or where are you at?

(41) 10-4. Both companies are back up in here.

(107) Can you get in off 71?

(41) Right. It's a road they're using for construction here.

(107) 10-4.

0406:23

(107) 107 on the scene.

(D) 107, 10-4.

0408:19

(107) 107 to dispatcher.

(D) 107.

(104) 104.

(107) ..explosion just as we pulled up in here. Get us all kinds of ambulances in here. Get us ambulances and at least a couple of three more companies.

(D) 107, you're reporting an explosion? You need extra companies?

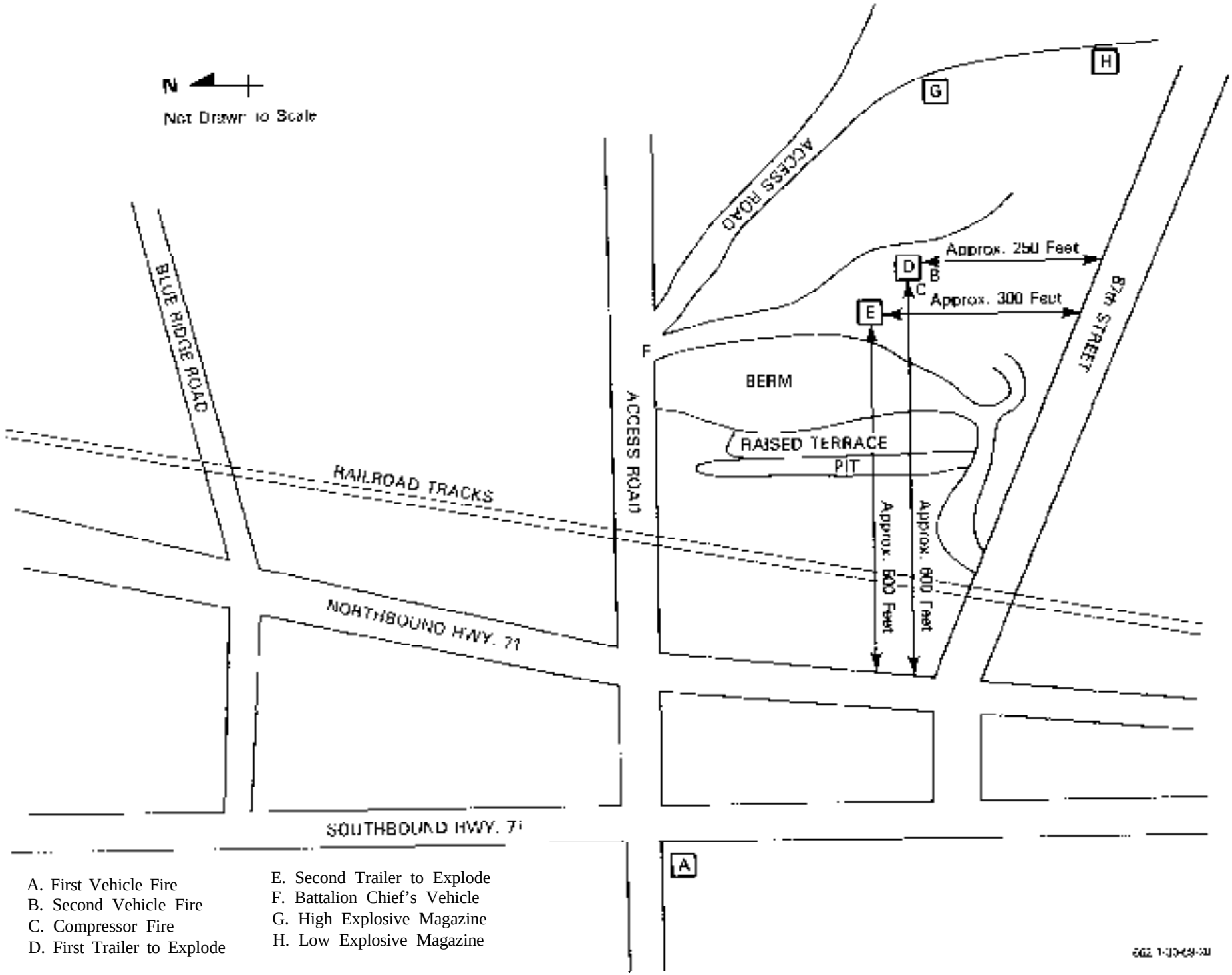
(107) 10-4. We're going to need ambulances.

(D) 10-4. Is that for firefighters?

(1071 10-4. We blowed the windshield clear out of our car and we're a quarter of a mile away.

Appendix B

Sketch of Construction Site Based on Diagram
Prepared by the Kansas City Police Department
Bomb and Arson Squad



A. First Vehicle Fire
B. Second Vehicle Fire
C. Compressor Fire
D. First Trailer to Explode
E. Second Trailer to Explode
F. Battalion Chief's Vehicle
G. High Explosive Magazine
H. Low Explosive Magazine

Appendix C

Tables of Separation Distances
for Blasting Agents

§55.218 Table of distances for storage of explosive materials.

Quantity of explosives		Distances in feet							
Magazine		Inhabited buildings		Public highways not in use		Passenger railways — public highways with traffic volume of more than 3,000 vehicles per day		Separation of magazines	
over	not over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
2	5	70	140	30	60	70	140	6	11
5	10	90	180	35	70	90	180	8	16
10	20	110	220	45	90	110	220	10	20
20	30	125	250	50	100	125	250	11	22
30	40	140	280	55	110	140	280	12	24
40	50	150	300	60	120	150	300	13	26
50	75	170	340	70	140	170	340	15	30
75	100	190	380	75	150	190	380	16	32
100	125	210	420	80	160	210	420	18	36
125	150	225	450	85	170	225	450	19	38
150	200	245	490	95	190	245	490	21	42
200	250	265	530	105	210	265	530	23	46
250	300	285	570	115	230	285	570	24	48
300	400	315	630	125	250	315	630	27	54
400	500	340	680	135	270	340	680	29	58
500	600	365	730	145	290	365	730	31	62
600	700	385	770	155	310	385	770	32	64
700	800	405	810	160	320	405	810	34	68
800	900	420	840	170	340	420	840	36	72
900	1,000	440	880	175	350	440	880	37	74
1,000	1,200	475	950	190	380	475	950	40	80
1,200	1,400	505	1,010	200	400	505	1,010	43	86
1,400	1,600	530	1,060	215	430	530	1,060	45	90
1,600	1,800	555	1,110	225	450	555	1,110	47	94
1,800	2,000	575	1,150	230	460	575	1,150	49	98
2,000	2,500	615	1,230	245	490	615	1,230	52	104
2,500	3,000	670	1,340	270	540	670	1,340	57	114
3,000	4,000	735	1,470	295	590	735	1,470	62	124
4,000	5,000	790	1,580	315	630	790	1,580	67	134
5,000	6,000	835	1,670	335	670	835	1,670	71	142
6,000	7,000	875	1,750	350	700	875	1,750	74	148
7,000	8,000	915	1,830	365	730	915	1,830	77	154
8,000	9,000	950	1,900	380	760	950	1,900	80	160
9,000	10,000	980	1,960	390	780	980	1,960	83	166
10,000	12,000	1,035	2,070	415	830	1,035	2,070	88	176
12,000	14,000	1,085	2,170	435	870	1,085	2,170	92	184
14,000	16,000	1,130	2,260	450	900	1,130	2,260	96	192
16,000	18,000	1,170	2,340	470	940	1,170	2,340	99	198
18,000	20,000	1,205	2,410	480	960	1,205	2,410	102	204
20,000	25,000	1,295	2,590	520	1,040	1,295	2,590	110	220
25,000	30,000	1,415	2,830	565	1,130	1,415	2,830	120	240
30,000	35,000	1,520	3,040	610	1,220	1,520	3,040	129	258
35,000	40,000	1,615	3,230	645	1,290	1,615	3,230	137	274
40,000	45,000	1,705	3,410	680	1,360	1,705	3,410	144	288
45,000	50,000	1,790	3,580	715	1,430	1,790	3,580	152	304
50,000	55,000	1,865	3,730	745	1,490	1,865	3,730	158	316
55,000	60,000	1,935	3,870	775	1,550	1,935	3,870	164	328
60,000	65,000	2,000	4,000	800	1,600	2,000	4,000	170	340
65,000	70,000	2,060	4,120	825	1,650	2,060	4,120	175	350
70,000	75,000	2,115	4,230	845	1,690	2,115	4,230	180	360
75,000	80,000	2,170	4,340	870	1,740	2,170	4,340	185	370
80,000	85,000	2,220	4,440	890	1,780	2,220	4,440	189	378
85,000	90,000	2,270	4,540	910	1,820	2,270	4,540	193	386
90,000	95,000	2,315	4,630	925	1,850	2,315	4,630	197	394
95,000	100,000	2,360	4,720	945	1,890	2,360	4,720	201	402
100,000	110,000	2,440	4,880	975	1,950	2,440	4,880	208	416
110,000	120,000	2,515	5,030	1,005	2,010	2,515	5,030	214	428
120,000	130,000	2,585	5,170	1,035	2,070	2,585	5,170	220	440
130,000	140,000	2,650	5,300	1,060	2,120	2,650	5,300	225	450
140,000	150,000	2,710	5,420	1,085	2,170	2,710	5,420	231	462
150,000	160,000	2,770	5,540	1,110	2,220	2,770	5,540	236	472
160,000	170,000	2,825	5,650	1,130	2,260	2,825	5,650	241	482
170,000	180,000	2,880	5,760	1,150	2,300	2,880	5,760	245	490
180,000	190,000	2,930	5,860	1,170	2,340	2,930	5,860	250	500
190,000	200,000	2,980	5,960	1,190	2,380	2,980	5,960	254	508
200,000	210,000	3,030	6,060	1,210	2,420	3,030	6,060	258	516
210,000	220,000	3,080	6,160	1,230	2,460	3,080	6,160	262	524
220,000	230,000	3,125	6,250	1,250	2,500	3,125	6,250	266	532
230,000	240,000	3,170	6,340	1,270	2,540	3,170	6,340	270	540
240,000	250,000	3,215	6,430	1,285	2,570	3,215	6,430	274	548
250,000	275,000	3,325	6,650	1,330	2,660	3,325	6,650	283	566
275,000	300,000	3,430	6,860	1,370	2,740	3,430	6,860	292	584

Table: American Table of Distances for Storage of Explosives (December 1910), as revised and approved by The Institute of Makers of Explosives - November 5, 1971

Notes to the Table of Distances for Storage of Explosives

(1) Terms found in the table of distances for 'storage of explosive materials are defined in §55.11.

(2) When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and, in addition, they should be separated from each other by not less than the distances shown for 'Separation of Magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways, and highways.

(3) All types of blasting caps in strengths through No. 8 cap should be rated at 1½ lbs. of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

(4) For quantity and distance purposes, detonating cord of 50 or 60 grains per foot should be calculated as equivalent to 9 lbs. of high explosives per 1,000 feet. Heavier or lighter core loads should be rated proportionately.

§55.219 Table of distances for storage of low explosives

Pounds		From inhabited building distance (feet)	From public railroad and highway distance (feet)	From above ground magazine (feet)
Over	Not over			
0	1,000	75	75	50
1,000	5,000	115	115	75
5,000	10,000	150	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300

Table: Department of Defense Ammunition and Explosives Standards, Table 5 - 4.1 extract; 4145.27 M, March 1969.

§55.220 Table of separation distances of ammonium nitrate and blasting agents from explosives or blasting agents. (l)(6)

Donor weight (pounds)		Minimum separation distance of acceptor from donor when barricaded (ft.)		Minimum thickness of artificial barricades (in.)
Over	Not over	Ammonium nitrate	Blasting agent	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	35	15
4,000	6,000	11	40	15
6,000	8,000	12	45	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25
25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	75	30
40,000	45,000	22	77	35
45,000	50,000	23	82	35
50,000	55,000	24	85	35
55,000	60,000	25	87	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	112	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	156	50
180,000	200,000	48	168	50
200,000	220,000	52	179	60
220,000	250,000	56	193	60
250,000	275,000	60	202	60
275,000	300,000	64	214	60

Table: National Fire Protection Association (NFPA) official Standard No. 492, 1968.

Notes of Table of Separation Distances of Ammonium Nitrate and Blasting Agents From Explosives or Blasting Agents

(1) ,This table specifies separation distances to prevent e&ion of ammomum mtrate and ammonium nitrate-based blasting agents by propagation from nearby stores of high explosives or blasting agents referred to in the table as the "donor" Ammonium nitrate, by itself, is not considered to be a donor when applying this table. Ammonium

nitrate, ammonium nitrate-fuel oil or combinations thereof are acceptors. If stores of ammonium nitrate are located within the sympathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate is to be included in the mass of the donor.

(2)When the ammonium nitrate and/or blasting agent is not the distances shown in the table must be multiplied by six. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the "donor." Where explosives storage is in bullet-resistant magazines or where the storage is protected by a bullet-resistant wall, distances and barricade thicknesses in excess of those prescribed in the table in $55.218 are not required.

(3) These distances apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer issued by the Fertilizer Institute.' Ammonium nitrate failing to pass the test must be stored at separation distances in accordance with the table in $55.218.

(4) These distances apply to blasting agents which pass the insensitivity test prescribed in regulations of the U.S. Department of Transportation (49 CFR Part 173).

(5) Earth or sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades. Natural barricades, such as hills or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the "donor" when the trees are bare of leaves, are also acceptable.

(6) For determining the distances to be maintained from inhabited buildings, passenger railways, and public highways, use the table in $55.218.

Definition and Test Procedures for Ammonium Nitrate Fertilizer, Fertilizer Institute 1015-18th St. N.W. Washington, D.C. 20036.

Table 6-4b

The American Table of Distance for Storage of Explosives
(As Revised and Approved by the Institute of Makers of Explosives in May, 1983)

QUANTITY OF EXPLOSIVES		DISTANCES IN FEET							
		Inhabited Buildings		Public Highways Class 3 to 5		Passenger Railways — Public Highways with Traffic Volume of Not More Than 3,000 Vehicles/Day		Separation of Magazines	
Pounds Over	Pounds (of) Over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
1	5	10	140	30	60	51	102	6	12
5	10	50	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	158	316	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	33	62
600	700	355	710	145	290	266	531	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	319	636	38	76
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	625	1,250	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	65	130
5,000	6,000	730	1,460	235	470	548	1,092	65	130
6,000	7,000	770	1,540	245	490	577	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	260	510	624	1,248	73	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	925	1,750	270	540	687	1,374	82	164
12,000	14,000	985	1,770	275	550	723	1,446	87	174
14,000	16,000	1,035	1,800	280	560	756	1,512	90	180
16,000	18,000	1,080	1,840	285	570	780	1,572	94	188
18,000	20,000	1,125	1,950	290	580	813	1,626	98	196
20,000	25,000	1,205	2,000	315	630	870	1,752	105	210
25,000	30,000	1,330	2,000	340	680	933	1,866	117	234
30,000	35,000	1,385	2,000	360	720	981	1,962	119	238
35,000	40,000	1,435	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,480	2,000	400	800	1,068	2,000	128	256
45,000	50,000	1,520	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,560	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,595	2,000	460	920	1,173	2,000	149	298
60,000	65,000	1,625	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,655	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,685	2,000	500	1,000	1,265	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,294	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,865	2,000	550	1,100	1,431	2,000	195	390
110,000	120,000	1,955	2,000	560	1,120	1,498	2,000	205	410
120,000	130,000	2,000	2,000	580	1,160	1,562	2,000	215	430
130,000	140,000	2,000	2,000	595	1,190	1,591	2,000	225	450
140,000	150,000	2,000	2,000	610	1,220	1,593	2,000	235	470
150,000	160,000	2,000	2,000	630	1,260	1,629	2,000	245	490
160,000	170,000	2,000	2,000	650	1,300	1,662	2,000	255	510
170,000	180,000	2,000	2,000	670	1,340	1,695	2,000	265	530
180,000	190,000	2,000	2,000	685	1,370	1,725	2,000	275	550
190,000	200,000	2,000	2,000	700	1,400	1,753	2,000	285	570
200,000	210,000	2,000	2,000	720	1,440	1,782	2,000	295	590
210,000	220,000	2,000	2,000	735	1,470	1,808	2,000	305	610
220,000	230,000	2,000	2,000	750	1,500	1,834	2,000	315	630
230,000	240,000	2,000	2,000	765	1,530	1,858	2,000	325	650
240,000	250,000	2,000	2,000	780	1,560	1,882	2,000	335	670
250,000	260,000	2,000	2,000	795	1,590	1,905	2,000	345	690
260,000	270,000	2,000	2,000	810	1,620	1,928	2,000	355	710
270,000	280,000	2,000	2,000	825	1,650	1,950	2,000	365	730
280,000	290,000	2,000	2,000	840	1,680	1,972	2,000	375	750
290,000	300,000	2,000	2,000	855	1,710	1,993	2,000	385	770

For SI Units: 1 lb = 0.454 kg; 1 ft = 0.505 m.

Appendix D

Excerpts from ATF Handbook
on Explosives and Blasting Agents

information as indicated by the headings and instructions thereon:

Held, the item on **Form 4710** requesting the identification of quantity, size and type of explosive materials including name of manufacturer and all manufacturer's marks of identification may be completed by identifying a commercial invoice. The identified commercial invoice must contain all the information required on the form and such invoice or a copy thereof must be attached to the Form 4710. Further, the requirement for identifying the quantity of explosive materials on Form 4710 may be met by recording the number and size of special fireworks articles.

C. Storage requirements

Under 27 CFR 55.205 of the regulations, explosive materials that are in the process of manufacture or are being physically handled in the operating process of a licensee or permittee do not have to be kept in storage facilities meeting the standards of regulations. The Bureau has determined that explosive materials that have been entered into the manufacturing process for special fireworks, as well as those contained in special fireworks that are partially assembled, should be considered explosive material in the process of manufacture. In addition, as special fireworks in a finished state flow through display packing buildings or areas, they should be considered explosive materials that are being physically handled in the operating process of a licensee or permittee.

Held, the following explosive materials, subject to the stated conditions, are not considered subject to the storage requirements of 27 CFR Part 55 while they are on the premises of a licensee or permittee pursuant to 27 CFR

1. Dry explosive powders and mixtures that have been entered into the manufacturing process for special fireworks articles;
2. Unfinished special fireworks articles; and
3. Individual special fireworks articles and packaged display segments that are received into designated packing buildings or areas for sorting, temporary storage, and packing into complete display units.

D. Preparation of the daily summary of magazine transactions

The regulations in 27 CFR 55.127 provide that at the close of business each day each licensee and permittee shall record by class of explosive materials, as prescribed in the explosives list, the total quantity received in and removed from each magazine during the day and the total remaining on hand at the end of the day.

Held, licensees and permittees may:

1. Maintain daily magazine summary records at any location on the business premises provided the records separately identify each magazine; and
2. Record the quantities of explosive materials received in and removed from the magazine during the day and the total remaining at the end of the day by showing, as applicable to the magazine contents:
   (a) The number and size of individual special fireworks articles in a finished state; or
   (b) The number of packaged display segments or packaged displays.

ATF Ruling 79-8, ATFB 1979-1, page 27

27 CFR 55.41: General Explosives Storage Facility Descriptions

In ATF Procedure 75-4, which became effective November I, 1975, the Bureau revised requirements for descriptions of explosives storage facilities that are tiled by applicants intending to store explosive materials. (This Procedure is incorporated in Industry circular 75-10.)

The Director, ATF, has determined that this additional descriptive information is required in order to insure compliance with the law and regulations. Accordingly, Form 4705, Application for License, and Form 4707, Application for Permit, have been revised. Following is the text of the Procedure, beginning with Section 3.

See. 3. Licenses. A person intending to engage in business as an importer, a manufacturer of, or a dealer in, explosive materials shall complete Form 4705, Application for License, in accordance with the instructions on the form, and forward the forms with the license fee to the office specified on the form. If approved, the Regional Regulatory Administrator (RRA) will issue a license and return a copy of the application to the applicant. At the time of renewal of a license the RRA may require the licensee to file a new or amended application; or additional descriptive pages to be attached to the application, upon a determination that the licensee's currently approved application is inaccurate or does not fully describe the storage facilities. If the application is denied, the applicant will be advised in writing of the reasons for the denial.

Sec. 4. Permits. A person intending to acquire, transport, ship, import or receive explosive materials in interstate or foreign commerce for his own use and not for resale shall complete Form 4707,

Application for Permit, in accordance with the instructions on the form and forward the forms with the permit fee to the office specified on the form. If approved, the RRA will issue a permit and return a copy of the application to the applicant. At the time of renewal of a permit the RRA may require the permittee to tile a new or amended application, or additional descriptive pages to be attached to the application, upon a determination that the permittee's currently approved application is inaccurate or does not fully describe the storage facilities. If the application is denied, the applicant will be advised in writing of the reasons for the denial.

Sec. 5. Storage, .01 If explosive materials are to be stored, the requirements of 27 CFR Part 55, Subpart K - Storage, must be complied with before the application will be approved. An applicant for a license or permit who intends to store explosive materials, shall fully describe the intended storage facilities to support the applicant's affirmation that the storage facilities meet the requirements set forth in 27 CFR Part 55, Subpart K-Storage.

.02 The description should, as a minimum, include the following information:

(a) The type of magazine (building, igloo, tunnel, portable box, portable trailer, etc.)

(b)The location and distance from applicant's place of business.

(c)The distance to the next nearest storage magazine.

(d) A description of significant terrain features and physical structures, such as buildings, roads, utilities and other facilities which could be damaged if the magazine exploded. Indicate the distance between the magazine and the feature.

(e) The materials (including dimensions and thicknesses) used for the structure (e.g. concrete, corrugated iron over wood, plywood, tin and earth, etc.)

(f) The security, physical safeguards, locks, safety equipment, and anti-theft measures.

(g) The dimensions and capacity of each magazine.

(h)The class of explosive materials to be stored in each magazine.

(i) The owner(s) of the magazine, if other than the applicant.

(j) The names and telephone numbers of individuals who could open the magazines for inspection by ATF officers.

(K) Any special conditions, such as inaccessibility in winter, etc.

Sec. 6. Effective Date. The effective date of this procedure is November 1, 1975.

Sec. 7, Inquiries. Inquiries regarding this ATF Procedure should refer to its number and be addressed to the office of your RRA.

ATF Procedure 75-4, 75 C.B. 79

(b) In order to secure the right of succession, the person or persons continuing the business or operations shall submit the license or permit and all copies furnished with the license or permit for endorsement of the succession to the regional regulatory administrator for the region in which the business or operations are conducted, within 30 days from the date on which the successor begins to carry on the business or operations.

§55.60 Certain continuances of business or operations.

A licensee or permittee who furnishes his license or permit to the regional regulatory administrator for correction, amendment, or endorsement, as provided in this subpart, may continue his business or operations while awaiting its return.

§55.61 Discontinuance of business or operations.

Where an explosive materials business or operations is either discontinued or succeeded by a new owner, the owner of the business or operations discontinued or succeeded shall, within 30 days, furnish notification of the discontinuance or succession and submit his license or permit and any copies furnished with the license or permit to the regional regulatory administrator for the region in which his business or operations was located. (See also §55.128.)

§55.62 State or other law.

A license or permit issued under this part confers no right or privilege to conduct, business or operations, including storage, contrary to State or other law. The holder of a license or permit issued under this part is not, by reason of the rights and privileges granted by that license or permit, immune from punishment for conducting an explosive materials business or operations in violation of the provisions of any State or other law. Similarly, compliance with the provisions of any State or other law affords no immunity under Federal law or regulations.

§55.63 Explosives magazine changes.

(a) General.

(1) The requirements of this section are applicable to magazines used for other than temporary (under 24 hours) storage of explosives.

(2) A magazine is considered suitable for the storage of explosives if the construction requirements of this part are met during the time explosives are stored in the magazine.

(3) A magazine is considered suitable for the storage of explosives if positioned in accordance with the applicable table of distances as specified in this part during the time explosives are stored in the magazine.

(4) For the purposes of this section, notification of the regional regulatory administrator may be by telephone or in writing. However, if notification of the regional regulatory administrator is in writing it must be at least three business days in advance of making changes in construction to an existing magazine or constructing a new magazine, and at least five business days in advance of using any reconstructed magazine or added magazine for the storage of explosives.

(b) *Exception.* Mobile or portable type 5 magazines are exempt from the requirements of paragraphs (c) and (d) of this section, but must otherwise be in compliance with paragraphs (a) (2) and (3) of this section during the time explosives are stored in such magazines.

(c) *Changes in magazine construction.* A licensee or permittee who intends to make changes in construction of an existing magazine shall notify the regional regulatory administrator describing the proposed changes prior to making any changes. Unless otherwise advised by the regional regulatory administrator, changes in construction may commence after explosives are removed from the magazine. Explosives may not be stored in a reconstructed magazine before the regional regulatory administrator has been notified in accordance with paragraph (a)(4) of this section that the changes have been completed.

(d) *Additional magazines.* A licensee or permittee who intends to construct or acquire additional magazines shall notify the regional regulatory administrator in accordance with paragraph (a)(4) of this section describing the additional magazines and the class and quantity of explosives to be stored in the magazine. Unless otherwise advised by the regional regulatory administrator, additional magazines may be constructed, or acquired magazines may be used for the storage of explosives. Explosives must not be stored in a magazine under construction. The regional regulatory administrator must be notified that construction has been completed.

(h) It shall be unlawful for any person to receive, conceal, transport, ship, store, barter, sell, or dispose of any explosive materials knowing or having reasonable cause to believe that such explosive materials were stolen.

(i) It shall be unlawful for any person —

(1) who is under indictment for, or who has been convicted in any court of, a crime punishable by imprisonment for a term exceeding one year;

(2) who is a fugitive from justice;

(3) who is an unlawful user of or addicted to marihuana (as defined in Section 4761 of the Internal Revenue Code of 1954) or any depressant or stimulant drug (as defined in section 201(v) of the Federal Food, Drug, and Cosmetic Act) or narcotic drug (as defined in section 4731(a) of the Internal Revenue Code of 1954); or

(4) who has been adjudicated as a mental defective or who has been committed to a mental institution; to ship or transport any explosive in interstate or foreign commerce or to receive any explosive which has been shipped or transported in interstate or foreign commerce.

(J) It shall be unlawful for any person to store any explosive material in a manner not in conformity with regulations promulgated by the Secretary. In promulgating such regulations, the Secretary shall take into consideration the class, type, and quantity of explosive materials to be stored, as well as the standards of safety and security recognized in the explosives industry.

(k) It shall be unlawful for any person who has knowledge of the theft or loss of any explosive materials from his stock, to fail to report such theft or loss within twenty-four hours of discovery thereof, to the Secretary and to appropriate local authorities.

Section 843. Licenses and user permits

(a) An application for a user permit or a license to import, manufacture, or deal in explosive materials shall be in such form and contain such information as the Secretary shall by regulation prescribe. Each applicant for a license or permit shall pay a fee to be charged as set by the Secretary, said fee not to exceed $200 for each license or permit. Each license or permit shall be valid for no longer than three years from date of issuance and shall be renewable upon the same conditions and subject to the same restrictions as the original license or permit and upon payment of a renewal fee not to exceed one-half of the original fee.

(b) Upon the filing of a proper application and payment of the prescribed fee, and subject to the provisions of this chapter and other applicable laws, the Secretary shall issue to such applicant the appropriate license or permit if —

(1) the applicant (including in the case of a corporation, partnership, or association, any individual possessing, directly or indirectly, the power to direct or cause the direction of the management and policies of the corporation, partnership, or association) is not a person to whom the distribution of explosive materials would be unlawful under section 842(d) of this chapter;

(2) the applicant has not willfully violated any of the provisions of this chapter or regulations issued hereunder;

(3) the applicant has in a State premises from which he conducts or intends to conduct business;

(4) the applicant has a place of storage for explosive materials which meets such standards of public safety and security against theft as the Secretary by regulations shall prescribe; and

(5) the applicant has demons- certified in writing that he is familiar with all published State laws and local ordinances relating to explosive materials for the location in which he intends to do business-

(c) The Secretary shall approve or deny an application within a period of forty-five days beginning on the date such application is received by the Secretary.

(d) The Secretary may revoke any license or permit issued under this section if in the opinion of the Secretary the holder thereof has violated any provision of this chapter or any rule or regulation prescribed by the Secretary under this chapter, or has become ineligible to acquire explosive materials under section 842(d). The Secretary's action under this subsection may be reviewed only as provided in subsection (e)(2) of this section.

(e)(l) Any person whose application is denied or whose license or permit is revoked shall receive a written notice from the Secretary stating the specific grounds upon which such denial or revocation is based. Any notice of a revocation of a license or permit shall be given to the holder of such license or permit prior to or concurrently with the effective date of the revocation.

(2) If the Secretary denies an application for, or revokes a license, or permit, he shall, upon request by the aggrieved party, promptly hold a hearing to review his denial or revocation. In the case of a revocation, the Secretary may upon a request of the holder stay the effective date of the revocation. A hearing under this section shall be at a location convenient to the aggrieved party.

The Secretary shall give written notice of his decision to the aggrieved party within a reasonable time after the hearing. The aggrieved party may, within sixty days after receipt of the Secretary's written decision, file a petition with the United States court of appeals for the district in which he resides or has his principal place of business for a judicial review of such denial or revocation, pursuant to sections 701 - 706 of title 5, United States Code.

(f) Licensees and permittees shah make available for inspection at all reasonable times their records kept pursuant to this chapter or the regulations issued hereunder, and shah submit to the Secretary such reports and information with respect to such records and the contents thereof as he shall by regulations prescribe. The Secretary may enter during business hours the premises (including places of storage) of any licensee or permittee, for the purpose of inspecting or examining (1) any records or documents required to be kept by such licensee or permittee, under the provisions of this chapter or regulations issued hereunder, and (2) any explosive materials kept or stored by such licensee or permittee at such premises. Upon the request of any State or any political subdivision thereof, the Secretary may make available to such State or any political subdivision thereof, any information which he may obtain by reason of the provisions of this chapter with respect to the identification of persons within such State or political subdivision thereof, who have purchased or received explosive materials, together with a description of such explosive materials.

(g) Licenses and permits issued under the provisions of subsection (b) of this section shall be kept posted and kept available for inspection on the premises covered by the license and permit.

Section 844. Penalties

(a) Any person who violates subsections (a) through (i) of section 842 of this chapter shall be fined not more than $10,000 or imprisoned not more than ten years, or both.

(b) Any person who violates any other provision of section 842 of this chapter shall be fined not more than $1,000 or imprisoned not more than one year, or both.

(c) Any explosive materials involved or used or intended to be used in any violation of the provisions of this chapter or any other rule or regulation promulgated thereunder or any violation of any criminal law of the United States shall be subject to seizure and forfeiture, and all provisions of the Internal Revenue Code of 1954 relating to the seizure, forfeiture, and disposition of firearms, as defined in section 5845(a) of that Code, shall, so far as applicable, extend to seizures and forfeitures under the provisions of this chapter.

(d) Whoever transports or receives, or attempts to transport or receive, in interstate or foreign commerce any explosive with the knowledge or intent that it will be used to kill, injure, or intimidate any individual or unlawfully to damage or destroy any building, vehicle, or other real or personal property, shall be imprisoned for not more than ten years, or fined not more than $10,000, or both; and if personal injury results shall be imprisoned for not more than twenty years or fined not more than $20,000, or both; and if death results, shall be subject to imprisonment for any term of years, or to the death penalty or to life imprisonment as provided in section 34 of this title.

(e) Whoever, through the use of the mail, telephone, telegraph, or other instrument of commerce, willfully makes any threat, or maliciously conveys false information knowing the same to be false, concerning an attempt or alleged attempt being made, or to be made, to kill, injure, or intimidate any individual or unlawfully to damage or destroy any building, vehicle, or other real or personal property by means of an explosive shall be imprisoned for not more than five years or fined not more than $5,000, or both.

(f) Whoever maliciously damages or destroys, or attempts to damage or destroy, by means of an explosive, any building, vehicle, or other personal or real property in whole or in part owned, possessed, or used by, or leased to, the United States, any department or agency thereof, or any institution or organization receiving Federal financial assistance shall be imprisoned for not more than ten years, or fined not more than $10,000, or both; and if personal injury results shall be imprisoned for not more than twenty years, or fined not more than $20,000, or both; and if death results shall be subject to imprisonment for any term of years, or to the death penalty or to life imprisonment as provided in section 34 of this title.

(g) Whoever possesses an explosive in any building in whole or in part owned, possessed, or used by, or leased to, the United States or any department or agency thereof, except with the written consent of the agency, department, or other person responsible for the management of such building, shall be imprisoned for not more than one year, or fined not more than $1,000, or both.

(h) Whoever —

Appendix E

Kansas City Code for Fire Prevention and Protection
Regarding Requirements for Blasting Permits
at Time of Explosion

Kansas City Uniform Fire Code for Explosives
and Blasting Agents and Hazardous Material

Permit used by City of Kansas City
at Time of Explosion

Sec. 14.29. Penalty.

Any person violating the provisions of this article shall upon conviction thereof, be fined not less than fifty dollars ($50.00) nor more than five hundred dollars ($500.00) for each and every offense. (C. S. No. 31761, S. 20.970, 5-13-66)

Sec. 14.30. Throwing of firecrackers or other fireworks.

(a) It shall be unlawful for any person to throw or otherwise deposit, or attempt to throw or otherwise deposit, any firecracker, squib, "cherry" bomb, grenade, torpedo or other combustible fireworks whatsoever into, at or upon any motor vehicle, or at any person or group of persons, or so near any such person or group of persons as to endanger same.

(b) Any person found guilty of violating the provisions of this section shall be fined not less than two hundred and fifty dollars ($250.00) nor more than five hundred dollars ($500.00), or sentenced to the municipal farm for not less than sixty days or for more than one year, or by both such fine and imprisonment. (C. S. No. 32920, S. A, l-27-67)

Secs. 14.31, 14.32. Reserved.

ARTICLE III. BLASTING*

Sec. 14.33. Permit-Required.

No person shall do or cause to be done any blasting within the city limits, or outside of such limits but on property owned or operated by the city, without first obtaining a permit therefor from the city engineer, subject to all the provisions of this article. (R.0.1956, S. 10.010; Ord. No. 37424, 10-24-69)

Amendment note-This section was formerly S. 14.38. Ord. No. 37424 repealed former sections 14.33 through 14.37, relating to blasters' examining board and licenses, reenacted other sections, and enacted new S. 14.42.

*Charter reference-power to regulate or prohibit storage and sale of explosives, S. 1(25).

Sec. 14.34. Same-Application.

All applications for permits for blasting or use of explosives shall be signed by the person or his duly authorized agent who desires to do the blasting described in the application and shall contain such other information regarding the proposed blasting as may be required by the city engineer. (R. 0. 1956, S. 10.010; Ord. No. 37424, 10-34-69)

Amendment note-- This section was formerly S. 14.39.

Cross reference-- Leaving explosives or other lethal devices in city, S. 26.15; storage of materials which may create explosion hazard in sewage works. S.29.55.

Sec. 14.35. Same-Issurance.

Whenever the city engineer shall find, from an examination of the application for blasting permit and such other information as he may deem necessary and proper to find or require, that such blasting can be done with safety to life and property, then he shall issue the permit as in this article provided. (R.0.1956, Secs. 10.010, 10.020; Ord. No. 37424, 10-24-69)

Amendment note-- This section was formerly S. 14.40(a); former 14.40(b) repealed by Ord. No. 37424.

Sec. 14.36. Same-Contents; duration.

Permits granted under this article shall specify the blasting to be permitted, the time such permit shall be valid and such other conditions and requirements as the city engineer may deem safe and proper, provided that such period of validity shall not extend beyond the calendar year in which the permit is issued. (R.0.1956, S. 10.030; Ord. No. 37424, 10-24-69)

Amendment note-- This section was formerly S. 14.41.

Sec. 14.37. Bond prerequisite to permit.

Before any permit referred to in this article shall have been issued for blasting, the applicant for such permit shall have executed a bond to the city conditioned that he will save the city harmless from and indemnify it from any loss or damage occurring by reason of such blasting. Such bond shall be in the sum of not less than the thousand dollars ($lO,OOO.OO) and not more than one hundred fifty thousand dollars ($l5O,OOO.OO),

with the specified amount being fixed by the city engineer, based upon the hazards involved, so that the amount of the bond will be a substantial and reasonable protection for the liability which might occur against the city. Said bond shall be in a form approved by the city counselor and shall be issued by a corporate surety company, approved by the director of finance. (R.O.1956, S. 10.080;Ord. No. 37434, l0-24-69:C.S. Ord. 4 1079, l-23-73)

Amendment note-- This section was formerly S. 14.42. C.S. Ord. 41079 increased the bond from not less than $1,000 nor more than 550,000 to present limits.

Sec. 14.38. Inspection of blasting.

At the time of granting a permit for blasting, the city engineer shall endorse upon it whether or not the blasting shall be done subject to the inspection of the city engineer. If the blasting is to be done subject to such inspection. the city engineer shall, within a reasonable time. inform the grantee of a permit of the requirements of such inspection. and such grantee shall not perform or cause to be performed-any blasting under the permit, contrary to such inspection requirements. (R.O. 1956, S. 10.090; Ord. No. 37424, 10-24-69; C.S. 41079, l-23-73)

Amendment note-- This section was formerly S. 14.43. C. S. Ord. 11079 changed duty of supervision to that of inspection.

Sec. 14.39. Rate to inspect blasting.

The city engineer shall carge the grantee of a blasting permit the actual cost involved for inspection of blasting. Additionally, the city engineer shall charge the grantee for the actual cost of any seismographic tests or readings involved in the performance of such blasting as he may require. Before the issuance of a permit for blasting, involving city inspection, the grantee shall deposit with the city engineer an inspection fee deposit of not less than eighty dollars $80.00, per working day. for the duration of the project, as described in the granter's application. In the event that the grantee has applied for an annual permit. the grantee shall keep on deposit with the city engineer an amount equal to sixty (60) calendar days anticipated inspection costs, which amount shall be periodically renewed by the grantee. At the completion of the blasting

operations, the city engineer, after paying for all inspections and associated costs, shall return any unused portion of the inspection deposit fee to the grantee. (R.O. S. 10.100, amend. by Ord. No. 19975, 2-24-56; Ord. No. 37424, 10-24-69; C.S. Ord. 4 1079, 1-23-73)

Amendment note-- This section was formerly S. 14.44. and set the rate at $2.50 per hour. Prior to C. S. for Ord. 41079, rate for supervision of blasting was $5.00 per hour.

Sec. 14.40. Inventories; disposition of explosives when permit expires.

Each applicant for a permit for blasting shall maintain a daily inventory in detail of all explosives in his possession for blasting purposes, from the date of the application to the final termination of the permit. Such inventory and stocks of explosives included therein shall be subject to inspection and examination at any reasonable time by the office of the city engineer. On the final termination of the permit, all stocks of explosives remaining unused by the permittee shall be shown or reported to the city engineer, as he may direct, and such disposition made thereof as shall be approved or directed by the city engineer. (R.0.1956, S.10.110, Ord. No. 37424, 10-24-69)

Amendment note --This section was formerly S. 14.45.

Sec. 14.41. Rules and regulations of city engineer.

The city engineer is hereby authorized to make and publish, from time to time, rules and regulations in conformity with and for carrying out the provisions of this article respecting the conditions for issuing blasting permits, including the acquisition, daily recording, storage, transportation, disposition of explosives and the method and manner of blasting. In making such rules and regulations the city engineer shall be guided by the recommendations of the United Association of Fire Underwriters. (R.0.1956, S.10.120; Ord. No. 37424, 10-24-69)

Amendment note --This section was formerly S.14.46. which included reference to blasters' examining board and licenses.

Sec. 14.42. Permit revoked.

If, in the opinion of the city engineer, any of the rules and regulations hereby authorized are violated in any manner, the blasting permit may be revoked. (Ord. No. 37434. 10-24-69)

Amendment note --This section is new in Ordinance No. 37424.

Appendix E (cont'd)

Kansas City Uniform Fire Code for Explosives and Blasting Agents and Hazardous Material

ARTICLE 77

EXPLOSIVES AND BLASTING AGENTS

Division I

GENERAL

Scope

Sec. 77.101. This article shall apply to the manufacture, possession, storage, sale, transportation and use of explosives and blasting agents.

Exceptions

Sec. 77.102. (a) Nothing in this article shall be construed as applying to:

1. The armed forces of the United States or the state militia.
2. Explosives in forms prescribed by the official United States Pharmacopoeia.
3. The sale, possession or use of fireworks.
4. The possession, transportation and use of small arms ammunition.
5. The possession, storage, transportation and use of not more than one pound of black sporting powder, 20 pounds of smokeless powder and 2000 small arms primers for hand loading of small arms ammunition for personal use.
6. The transportation and use of explosives or blasting agents by the United States Bureau of Mines, the Federal Bureau of Investigation, the United States Secret Service or Police and Fire Departments acting in their official capacities.
7. Special industrial explosive devices which in the aggregate contain less than 50 pounds of explosives.

Definitions

Sec. 77.103. For definitions of BLASTING AGENT, BULLET RESISTANT, INHABITED BUILDING, EXPLOSIVES, GUNPOWDER, SPECIAL INDUSTRIAL EXPLOSIVE DEVICE, SPECIAL INDUSTRIAL HIGH-EXPLOSIVE MATERIAL and TEST BLASTING CAP NO. 8, see Article 9.

Permits

Sec. 77.104. (a) Permits shall be obtained:

1. To manufacture, possess, store, sell or otherwise dispose of explosives or blasting agents.
2. To transport explosives or blasting agents.
3. To, use explosives or blasting agents.
4. To operate a terminal for handling explosives or blasting agents.
5. To deliver to or receive explosives or blasting agents from a carrier at a terminal between the hours of sunset and sunrise.

6. To transport blasting caps or electric blasting caps on the same vehicle with explosives.

(b) Permits required by Section 77,104 (a) of this article shall not be issued for:

1. Liquid nitroglycerin.
2. Dynamite (except gelatin dynamite) containing over 60 percent of liquid explosive ingredient,
3. Dynamite having an unsatisfactory absorbent or one that permits leakage of a liquid explosive ingredient under any conditions liable to exist during storage.
4. Nitrocellulose in a dry and uncompressed condition in quantity greater than 10 pounds net weight in one package.
5. Fulminate of mercury in a dry condition and fulminate of all other metals in any condition except as a component of manufactured articles not hereinafter forbidden.
6. Explosive compositions that ignite spontaneously or undergo marked decomposition, rendering the products or their use more hazardous, when subjected for 48 consecutive hours or less to a temperature of 167°F.
7. New explosives until approved by the U . S . Department of Transportation, except that permits may be issued to educational, governmental or industrial laboratories for instruction or research purposes.
8. Explosives condemned by the U.S. Department of Transportation.
9. Explosives not packed or marked in accordance with the requirements of the U.S. Department of Transportation.
10. Explosives containing an ammonium salt and a chlorate.

(c) No person shall keep or store, nor shall any permit be issued to keep or store, any explosives at any place of habitation or within 100 feet thereof.

(d) No person possessing a permit for storage of explosives at any place shall keep or store any greater amount or other kind of explosives than are authorized in such permit.

(e) The chief may require that any operations permitted under the provisions of Section 77.104 (a) 2 or 3 shall be supervised at any or all times by employees of the fire department designated by the chief to see that all safety and fire regulations are observed. Where, in the opinion of the chief, no undue hazard to life or property exists, the required supervision may be waived.

Bond Required

Sec. 77.105. Before a permit is issued, as required by Subsection (a) 3, of Section 77.104, the applicant shall file with the jurisdiction a corporate surety bond in the principal sum of $100,000 or a public liability insurance policy for the same amount for the purpose of the payment of all damages to persons or property which arise from, or are caused by, the conduct of any act authorized by the permit upon which any legal judgment results. The chief may specify a greater or lesser amount when, in his opinion, conditions at the location of use indicate a greater or

lesser amount is required. Public agencies shall be exempt from this bond requirement.

General Requirements

Sec. 77.106. (a) The manufacture of explosives shall be prohibited unless such manufacture is authorized by the chief.

(b) The storage of explosives and blasting agents is prohibited within the limits established by law as the limits of the district in which such storage is to be prohibited, except for temporary storage for use in connection with approved blasting operations, provided, however, this prohibition shall not apply to wholesale and retail stocks of small arms ammunition, explosive bolts, explosive rivets or cartridges for explosive-actuated power tools in quantities involving less than 500 pounds of explosive material.

(c) The chief may limit the quantity of explosives or blasting agents to be permitted at any location.

(d) No person shall possess , offer for sale, sell or display explosives or blasting agents at any location not authorized by permit issued by the chief.

Division II

STORAGE

Storage of Explosives

Sec. 77.201. (a) Explosives, including special industrial high-explosive materials, shall be stored in magazines which meet the requirements of this article.

(b) Magazines shall be at all times in the custody of a competent person who shall be at least 21 years of age and who shall be held responsible for compliance with all safety precautions.

(c) Smoking, matches, open flames, spark-producing devices and firearms shall be prohibited inside or within 50 feet of magazines. Combustible materials shall not be stored within 50 feet of magazines.

(d) The land surrounding magazines shall be kept clear of brush, dried grass, leaves, trash and debris for a distance of at least 50 feet.

(e) Magazines shall be kept locked except when being inspected or when explosives are being placed therein or being removed therefrom.

(f) Magazines shall be kept clean, dry and free of grit, paper, empty packages and rubbish.

(g) Magazines shall not be provided with other than approved artificial heat or light. Approved electric safety flashlights or safety lanterns may be used.

(h) Blasting caps, electric blasting caps, detonating primers, primed cartridges or any item such as a squib or electric match, the function of which is to ignite or detonate propellants, fireworks or explosives, shall not be stored in the same magazine with other explosives.

(i) Magazines shall be of two types, namely, Class I and Class II.

(j) Storage of explosives in quantities exceeding 100 pounds shall be in a Class I magazine, except that a Class II magazine may be used for temporary storage of a larger quantity of explosives at the site of blasting operations where such amount constitutes not more than one day's supply for use in current operations. At the end of the day's operations any remaining explosives shall be safely destroyed or returned to a Class I magazine.

(k) Storage of explosives in quantities of 100 pounds or less shall be in Class I or Class II magazines, except that explosives in any quantity when stored in remote locations shall be in Class I, bullet-resistant magazines.

(1) Class I and Class II magazines shall be located away from inhabited buildings, passenger railways, public highways and other magazines in conformity with the provisions of the American Table of Distances for Storage of Explosives, Table No. 77.201, except as provided in Subsection 77.201 (m).

(m) At the site of blasting operations, a distance of not less than 100 feet shall be maintained between Class I magazines and the blast area.

Class II magazines shall be kept not less than 150 feet from the blast area when the quantity of explosives temporarily kept therein is in excess of 25 pounds and not less than 50 feet when the quantity of explosives is 25 pounds or less.

(n) Packages of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives. Opened packages of explosives shall be securely closed before being returned to a magazine.

(0) Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, blasting agents and oxidizers used in compounding blasting agents. The quantity of blasting agents and oxidizers shall be included when computing the total quantity of explosives for determining distance requirements.

(p) When an explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosive, then the person in possession of such explosive shall immediately report the fact to the chief and, upon his authorization, shall proceed to destroy such explosives and clean floors, stained with nitroglycerin in accordance with the instructions of the manufacturer. Only experienced persons shall do the work of destroying explosives.

TABLE NO. 77.201-AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES AND MINIMUM SEPARATION OF AMMONIUM NITRATE AND BLASTING AGENTS FROM EXPLOSIVES AND BLASTING AGENTS

EXPLOSIVES		DISTANCE IN FEET WHEN STORAGE IS BARRICADED			
				From Passenger Railways—Public Highways with Traffic Volume of More than 3,000 Vehicles/Day	
Pounds Over	Pounds Not Over	From Inhabited Buildings	From Public Highways Classes A to D	Barricaded	Separation of Magazines
2	5	70	30	51	6
5	10	90	35	64	8
10	20	110	45	81	10
20	30	125	50	93	11
30	40	140	55	103	12
40	50	150	60	110	14
50	75	170	70	127	15
75	100	190	75	139	16
100	125	200	80	150	18
125	150	215	85	159	19
150	200	235	95	175	21
200	250	255	105	189	23
250	300	270	110	201	24
300	400	295	120	221	27
400	500	320	130	238	29
500	600	340	135	253	31
600	700	355	145	266	32
700	800	375	150	278	33
800	900	390	155	289	35
900	1,000	400	160	300	36
1,000	1,200	425	165	318	39
1,200	1,400	450	170	336	41
1,400	1,600	470	175	351	43
1,600	1,800	490	180	366	44
1,800	2,000	505	185	378	45
2,000	2,500	545	190	408	49
2,500	3,000	580	195	432	52
3,000	4,000	635	210	474	58
4,000	5,000	685	225	513	61
5,000	6,000	730	235	546	65
6,000	7,000	770	245	573	68
7,000	8,000	800	250	600	72
8,000	9,000	835	255	624	75
9,000	10,000	865	260	645	78
10,000	12,000	875	270	687	82

(Continued)

TABLE NO. 77.201-AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES AND MINIMUM SEPARATION OF AMMONIUM NITRATE AND BLASTING AGENTS FROM EXPLOSIVES AND BLASTING AGENTS (Continued)

EXPLOSIVES		DISTANCE IN FEET WHEN STORAGE IS BARRICADED			
Pounds Over	Pounds Not Over	From Inhabited Buildings	From Public Highways Classes A to D	From Passenger Railways—Public Highways with Traffic Volume of More than 3,000 Vehicles/Day	Separation of Magazines
				Barricaded	
12,000	14,000	855	275	723	87
14,000	16,000	900	280	756	90
16,000	18,000	940	285	786	94
18,000	20,000	975	290	813	98
20,000	25,000	1,055	315	876	105
25,000	30,000	1,130	340	933	112
30,000	35,000	1,205	360	981	119
35,000	40,000	1,275	380	1,026	124
40,000	45,000	1,340	400	1,068	129
45,000	50,000	1,400	420	1,104	135
50,000	55,000	1,460	440	1,140	140
55,000	60,000	1,515	455	1,173	145
60,000	65,000	1,565	470	1,206	150
65,000	70,000	1,610	485	1,236	155
70,000	75,000	1,655	500	1,263	160
75,000	80,000	1,695	510	1,293	165
80,000	85,000	1,730	520	1,317	170
85,000	90,000	1,760	530	1,344	175
90,000	95,000	1,790	540	1,368	180
95,000	100,000	1,815	545	1,392	185
100,000	110,000	1,835	550	1,437	195
110,000	120,000	1,855	555	1,479	205
120,000	130,000	1,875	560	1,521	215
130,000	140,000	1,890	565	1,557	225
140,000	150,000	1,900	570	1,593	235
150,000	160,000	1,935	580	1,629	245
160,000	170,000	1,965	590	1,662	255
170,000	180,000	1,990	600	1,695	265
180,000	190,000	2,010	605	1,725	275
190,000	200,000	2,030	610	1,755	285
200,000	210,000	2,055	620	1,782	295
210,000	230,000	2,100	635	1,836	315
230,000	250,000	2,155	650	1,890	335
250,000	275,000	2,215	670	1,950	360
275,000	300,000	2,275	690	2,000	385

(Continued)

given for separation of magazines in Table No. 77.201. The minimum separation between stores of explosives or blasting agents from barricaded stores of blasting agents shall be not less than 60 percent of the distance given for separation of magazines in Table No. 77.201. The distance determined from the above shall be multiplied by six if barricades are not provided.

For the purpose of this note, the weight of the larger mass shall be used to determine the required separation; however, the weight of ammonium nitrate may be reduced by 50 percent. The required separation between inhabited buildings, public highways and railroads shall be not less than set forth in Table No. 77.201 using the sum of all explosives and blasting agents that are at a distance less than set forth in the table. The distance shall be measured from closest edge of the explosive material. Class A explosives as defined by the Department of Transportation shall be within Class I magazines. For the purposes of this note, artificial barricades of sand or dirt shall have a thickness not less than the following:

Weight of Explosive or Blasting Agent		Barricade Thickness (Inches)
Pounds Over	Pounds Not Over	
	2,000	12
2,000	6,000	15
6,000	12,000	20
12,000	25,000	25
25,000	40,000	30
40,000	60,000	35
60,000	100,000	40
100,000	200,000	50
200,000	300,000	60

Gunpowder

Sec. 77.202. (a) The chief may authorize the storage of smokeless powder not to exceed 100 pounds, black sporting powder not to exceed 5 pounds, and small arms primers not to exceed 20,000 in approved establishments. Smokeless powder exceeding 20 pounds shall be stored in an approved Class II magazine. Black sporting powder, when authorized, shall be stored in an approved Class II magazine. Small arms primers shall be stored in a manner prescribed by the chief.

(b) The display of smokeless powder shall be only in original containers and shall not exceed 20 pounds.

(c) Small arms primers shall not be stored or displayed with smokeless powder or other explosives.

(d) Smokeless powder shall not be repackaged except in original-type containers, and repackaging shall be permitted only in locations designated and approved by the chief.

(e) The repackaging of black sporting powder shall not be permitted.

(Continued)

NOTES:

1. For exceptions, see Section 77.201 (n).
2. "Natural barricade" means natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.
3. "Artificial barricade" means an artificial mound or revetted wall of earth of a minimum thickess of 3 feet, except as set forth in Note 13.
4. "Barricaded" means that a building containing explosives is effectually screened from a magazine, building, railway or highway, either by a natural barricade or by an artificial barricade of such height that a straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine or building, or to a point 12 feet above the center of a railway or highway will pass through such intervening natural' or artificial barricade.
5. "Inhabited building" means a building regularly occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, store or other structure where people are accustomed to assemble, except any building or structure occupied in connection with the manufacture, transportation, storage or use of explosives.
6. '"Railway" means any steam, electric or other railroad or railway which carries passengers for hire.
7. '"Highway" means any street or public road. '"Public highways, Classes A to D," are highways with average traffic volume of 3000 or less vehicles per day.
8. When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways and highways and, in addition, they shall be separated from each other by not less than the distances shown for "separation of magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives.

   EXCEPTION: Two or more magazines may be separated from each other by less than the specified "separation of magazines" distances when such two or more magazines, as a group, are considered as one magazine and the total quantity of explosives stored in such group shall be treated as if stored in a single magazine located on the site of any magazine of the group and shall comply with the minimum of distances specified from other magazines, inhabited buildings, railways or highways.
9. This table applies only to the manufacture and permanent storage of commercial explosives. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles or other heavily encased explosives.
10. All types of blasting caps in strengths through No. 8 cap shall be rated at 1½pound explosives per 1000 caps. For strengths higher than No. 8 cap, the manufacturer shall be consulted.
11. For quantity and distance purposes, detonating cord of 50 to 60 grains per square foot shall be calculated as equivalent to 9 pounds of high explosives per 1000 feet. Heavier or lighter core loads shall be rated proportionately.
12. For unbarricaded condition, the specified distance for "barricaded" shall be doubled.
13. The minimum separation between stores of explosives or blasting agents from barricaded stores of ammonium nitrate shall be not less than 16.7 percent of the distance

ass I Magazines

Sec. 77.203. (a) A magazine may be a building or excavation, tunnel or igloo, military-type magazine or a portable magazine constructed as required in this action.

(b) Class I magazines shall be bullet resistant) fire resistant, weatherproof, theft instant and well ventilated.

EXCEPTION: Magazines used for the storage of blasting agents, Class B and Class C explosives need not be bullet resistant.

(c) Building-type magazines shall be constructed of masonry, wood, metal or a mbination of these materials when bullet resistance is required.

1. Masonry units not less than 8 inches in thickness with all hollow spaces filled with concrete, well-tamped sand or equivalent material, or
2. Reinforced concrete not less than 6 inches in thickness, or
3. Steel walls of minimum manufacturer's standard gage No. 14 (.0747 inch) may be used, provided there are two layers spaced at least 6 inches apart with all hollow spaces filled with concrete, well-tamped sand or equivalent material, or
4. One layer of manufacturer's standard gage No. 6 (.1943-inch) or heavier steel, lined on the interior with a minimum of 4 inches of wood, or
5. Two layers of manufacturer's standard gage No. 6 (.1943-inch) or heavier steel, spaced a minimum l/2 inch apart and lined on the interior with a minimum of 2 inches of wood, or
6. Two layers of wood, at least 2 inches nominal thickness each, spaced a minimum of 4 inches apart with the hollow spaces filled with concrete, well-tamped sand or equivalent material.
7. The roof shall also be protected when the magazine is located where it is possible to fire a bullet directly through it into the explosives stored inside.

NOTE: Any sheeting used shall be tongue-and-groove lumber, plywood or approved qual.

(d) Doors shall be of bullet-resistant construction and shall be installed in such manner that the hinges and hasps cannot be removed when. the doors are locked and closed.

Doors shall be equipped with substantial and approved means of locking. Each door shall be equipped with two separate locks or a lock requiring two separate keys. All padlocks shall be protected with steel caps constructed so as to prevent awing or lever action on the locks or hasps.

(e) Floors of magazines shall be securely fastened in place and shall be capable of withstanding the loads imposed.

(f) The roofs and exterior sides of building-type magazines may be of wood construction covered with not less than No. 26 gage (.016-inch) steel metal. roofs of building-type magazines located where it is possible to fire a bullet directly through the roof into the magazine at such an angle that the bullet would trike the explosives therein shall be constructed according to Section 77.203 (c)

or equipped with a sand tray located at the eave line and covering the entire magazine ceiling area except that necessary for ventilation. Sand in the sand tray shall be maintained at a depth of not less than 4 inches.

(g) Magazines shall be ventilated to minimize dampness and heating of stored explosives. Ventilation openings shall be screened with 14 mesh, No. 21 gage wire to prevent the entrance of sparks and shall be protected in a manner that will maintain the bullet resistance of the magazine.

(h) Magazine interiors shall have a smooth finish with all nails, screws, bolts and nuts countersunk or blinded.

(i) The approaches to magazines shall be provided with warning signs reading EXPLOSIVES-KEEP OFF in red letters not less than 4 inches in height and a stroke of at least % inch. The lettering shall be imposed upon a white background. Location of signs shall be within 100 feet of the magazine and so placed that a bullet through the sign will not strike the magazine.

(j) Post an additional warning sign on the door with the letters not less than 2 inches in height and a stroke of Y4 inch on a contrasting background reading EXPLOSIVES, DANGEROUS.

Class II Magazines

Sec. 77.204. (a) Class II magazines shall be constructed of wood, metal, fiber or a combination thereof, or any equivalent construction.

(b) Class II magazines shall be well constructed as follows:

1, Two-inch nominal thickness lumber, covered on the exterior with a minimum of No. 20 manufacturer's standard gage steel, or

2. Two thicknesses of l-inch plywood covered on the exterior with a minimum of No. 20 manufacturer's standard gage steel, or

3. Fiber equal in strength to wood as indicated in Items Nos. 1 and 2 above, covered on the exterior with a minimum of No. 20 manufacturer's standard gage steel, or

4. Minimum No. 14 manufacturer's standard gage steel, lined on the interior with one layer of 1 -inch-thick plywood, or

5. Material of equal strength and fire resistance.

(c) Class II magazines containing explosives and located in buildings shall be located for easy removal in case of fire and, when required by the chief, shall be equipped with approved wheels or casters.

(d) Class II magazines shall be painted red and, when size permits, shall bear lettering in white on sides and top at least 3 inches high with a %-inch stroke which reads EXPLOSIVES.

(e) Class II magazines containing explosives left at locations where no one is in attendance shall be adequately secured to prevent their theft.

Division III

USE, HANDLING AND TRANSPORTATION

Use and Handling of Explosives

Sec. 77.301. (a) Blasting operations shall be conducted during daylight hours ‘except when authorized at other times by the chief.

(b) The handling and firing of explosives shall be performed only by the person possessing a valid Explosives Certificate issued by the chief or by employees under his direct personal supervision who are at least 18 years of age.

(c) A person while under the influence of intoxicants or narcotics shall not handle explosives.

(d) A person shall not smoke or carry matches while handling explosives or while in the vicinity thereof.

(e) An open-flame light shall not be used in the vicinity of explosives.

(f) Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph or steam utilities, the blaster shall notify the appropriate representative of such utilities at least 24 hours in advance of blasting, specifying the location and intended time of such blasting. In an emergency, this time limit may be waived by the chief.

(g) Blasting operations shall be conducted in accordance with nationally recognized good practice.

(h) Before a blast is fired, the person in charge shall make certain that all surplus explosives are in a safe place, all persons and vehicles are at a safe distance or under sufficient cover and a loud warning signal has been sounded.

(i) Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radio or radar transmitters, lightning, adjacent power lines, dust storms or other sources of extraneous electricity.

These precautions shall include:

1. The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electrical storm.
2. The posting of signs warning against the use of mobile radio transmitters on all roads within approximately 500 feet of the blasting operations.
3. Compliance with nationally recognized good practice when blasting within one and one half miles of broadcast or high-power shortwave transmitters.

(j) When blasting is done in a congested area or in close proximity to a building, structure, railway, highway or any other installation that may be damaged by material being thrown into the air, the blast shall be covered with an adequate blasting mat.

(k) Tools used for opening packages of explosives shall be constructed of nonsparking materials.

(1) Empty boxes and paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose but shall be

disposed of in a manner approved by the chief.

(m) Explosives shall not be abandoned.

Transportation of Explosives

Sec. 77.302. (a) Explosives shall not be carried or transported in or upon a public conveyance or vehicles carrying passengers for hire.

(b) Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and shall be in good mechanical condition. If vehicles do not have a closed body, the explosives shall be covered with a flameproof and moistureproof tarpaulin or other effective protection against moisture and sparks. Such vehicles shall have tight floors, and exposed spark-producing metal on the inside of the body shall be covered with wood or other nonsparking material to prevent contact with packages of explosives. Packages of explosives shall not be loaded above the sides of open-body vehicles.

(c) Explosives shall not be transported on any vehicle not authorized by the chief.

(d) Every vehicle when used for transporting explosives shall be equipped with not less than one approved-type fire extinguisher with a minimum rating of 2-A, 10-B:C, or two approved-type fire extinguishers, one of which shall have a minimum rating of 2-A and the other a minimum rating of l0-B:C. Extinguishers shall be so located as to be readily available for use.

(e) It shall be the duty of the person to whom a permit has been issued to transport explosives over the highways of the municipality, to inspect those vehicles employed by him to determine that:

1. Fire extinguishers are filled and in operating condition.
2. Electric wires are insulated and securely fastened.
3. The motor, chassis and body are reasonably clean and free of excessive grease and oil.
4. The fuel tank and fuel line are securely fastened and are not leaking.
5. Brakes, lights, horn, windshield wipers and steering mechanism are functioning properly.
6. Tires are properly inflated and free of defects.
7. The vehicle is in proper condition for transporting explosives.

(f) Spark-producing metals or spark-producing metal tools shall not be carried in the body of a vehicle transporting explosives.

(g) Only those dangerous articles authorized by the U.S. Department of Transportation to be loaded with explosives shall be carried in the body of a vehicle transporting explosives.

(h) A person shall not smoke, carry matches or any other flame-producing device, or carry any firearms or loaded cartridges while in or near a vehicle transporting explosives, or drive, load or unload any such vehicle in a careless or reckless manner.

(i) Vehicles transporting explosives shall be in the custody of drivers who are physically fit, careful, capable, reliable, able to read and write the English

language, not addicted to the use or under the influence of intoxicants or narcotics and not less than 21 years of age. They shall be familiar with state and municipal traffic regulations and the provisions of this article governing the transportation of explosives.

(j) Vehicles transporting explosives shall display explosives signs on both sides, front and rear conforming to the requirements of the vehicle code.

(k) Blasting caps and electric blasting caps when transported on the same vehicle with other explosives shall be separated from the other explosives by containment within a Class II magazine.

(1) Vehicles transporting explosives shall be routed to avoid congested traffic and densely populated areas.

(m) Explosives shall not be transported through any completed vehicular tunnel or subway except on approval of the chief.

(n) Vehicles transporting explosives shall not be left unattended at any time within the jurisdiction.

(o) Unless authorized by the chief, a person other than the driver and one assistant who is at least 18 years of age shall not ride on any vehicle transporting explosives.

(p) The fire and police departments shall be promptly notified when a vehicle transporting explosives is involved in an accident, breaks down or catches fire. Only in the event of such an emergency shall the transfer of explosives from one vehicle to another be allowed on highways within the jurisdiction and only when qualified supervision is provided. Except in such an emergency, a vehicle transporting explosives shall not be parked before reaching its destination except at stopping and parking places designated and approved by the chief.

(q) Delivery shall be made only to authorized persons and into approved magazines or approved temporary storage or handling areas.

(r) Vehicles containing explosives shall not be taken into a garage or repair shop for repairs or storage.

Explosives and Blasting Agents at Terminals

Sec. 77.303. (a) The chief may designate the location and specify the maximum quantity of explosives or blasting agents which may be loaded, unloaded, reloaded or temporarily retained at each terminal where such operations are permitted.

(b) Shipments of explosives or blasting agents delivered to carriers shall comply with the U.S. Department of Transportation regulations.

(c) Carriers shall immediately notify the chief when explosives or blasting agents are received at terminals.

(d) Carriers shall immediately notify consignees of the arrival of explosives or blasting agents at terminals.

(e) Truck terminals where explosives are loaded, unloaded or transferred shall conform to the following conditions:

1. There shall be no aboveground storage tanks of flammable or combustible

liquids or other hazardous substances on the terminal proper or on immediate adjoining property which would present a significant exposure hazard.

2. There shall be no structures or occupancies on immediately adjoining property which would constitute a serious exposure hazard to the terminal.
3. The terminal property shall be sufficiently large that dock or vehicle storage areas containing explosives shall be a minimum of 50 feet from any structure on adjoining property.
4. Adequate access to adjoining streets shall be provided to and from the terminal property. Local routes between terminals and deviations from state approved routes shall be prescribed by the chief.
5. Explosives shall be kept in vehicles to the greatest extent possible. During transferring or loading operations, the explosives should remain on the ground or on docks for as short a time as possible.
6. Specific areas of docks shall be designated for the temporary "storage" of explosives during loading or transferring operations. A minimum distance shall be specified and maintained between this designated area and all other materials on the dock. Combustible storage and particularly flammable or combustible liquids shall be kept at the greatest possible distance from this designated area.
7. At all times, a watchman or guard shall be on duty on the terminal property, and he shall be capable of driving all equipment in the area. At times when there are a substantial number of vehicles carrying explosives in the terminal, additional persons capable of driving shall be provided.
8. Adequate security against unauthorized persons' entering the terminal shall be provided. In metropolitan areas, this will require a fence and adequate gates.
9. The terminal shall be adequately lighted for normal observation of all vehicles containing explosives.
10. Adequate fire-protection appliances shall be provided for the loading dock near the designated explosives area and near parked vehicles.
11. A specific area of the terminal property shall be designated for vehicles containing explosives.
12. Vehicles containing any special inherent hazard, such as mechanical refrigeration equipment, shall be kept separated from the area designated for the parking of explosives vehicles.
13. Shipments of explosives shall be transported without unnecessary delay, keeping the explosives in the terminal an absolute minimum length of time, not to exceed 48 hours, excluding Sundays and holidays.

Blasting Agents, General

Sec. 77.304. (a) Except when subject to U.S. Department of Transportation regulations, blasting agents shall be stored, handled and used in the same manner as explosives.

(b) Any ammonium nitrate stored at a closer distance to the blasting agent

storage area than as provided in (c) below shall be added to the quantity of blasting agents to calculate the total quantity involved for application of Table No. 77.20 1.

(c) Minimum intraplant separation distances between mixing units and the ammonium nitrate storage areas and blasting agents storage areas shall be in conformity with Table No. 77.201, Note 13)

Mixing Blasting Agents

Sec. 77.305. (a) Buildings or other facilities used for mixing blasting agents shall be located away from inhabited buildings, passenger railways and public highways, in accordance with the provisions of Table No. 77.201.

(b) Not more than eight hours' production of blasting agents or the limit determined by Table No. 77.201, whichever is less, shall be permitted in or near the building or other facility used for mixing blasting agents. Larger quantities shall be stored in magazines.

(c) Buildings or other facilities used for the mixing of blasting agents shall be designed and constructed in accordance with the Building Code.

(d) Compounding and mixing of recognized formulations of blasting agents shall be conducted in accordance with nationally recognized good practice.

(e) Smoking or open flames shall not be permitted in or within 50 feet of any building or facility used for the mixing of blasting agents.

(f) Empty oxidizer bags shall be disposed of daily in a manner approved by the chief.

Transportation of Blasting Agents

Sec. 77.306. Vehicles transporting blasting agents not subject to U.S. Department of Transportation regulations shall comply with all requirements of Section 77.302 except that they shall be marked or placarded on both sides, front and rear, with the words BLASTING AGENTS in letters not less than 4 inches in height and approximately a 5/8-inch stroke on a contrasting background.

Seizure of Explosives and Blasting Agents

Sec. 77.307. The chief may seize, take, remove or cause to be removed at the expense of the owner all explosives, ammunition or blasting agents offered or exposed for sale, stored, possessed or transported in violation of this article.

Division IV

MANUFACTURING, ASSEMBLING AND TESTING

Manufacturing, Assembling and Testing

Sec. 77.401. Any person planning to manufacture, assemble, test or load explosives, ammunition, blasting agents or fireworks shall furnish to the chief the following information:

1. The exact location of the place of manufacture.
2. The kind or kinds of explosives, ammunition, blasting agents or fireworks to be manufactured or processed and the property of hazardous materials to be used.
3. The names and addresses of individual owners, partners or officers of a corporation.
4. A map of the operating premises with the operating buildings indicated in which greater than one pound of explosives is manufactured, handled, used or stored. The maximum amount of explosives greater than one pound to be used in each building, number of persons in each operating building, barricade locations and dimensions and the location and capacity of storage magazines.
5. This article shall not be construed as applying to, or prohibiting the mixture of, blasting agents such as nitrocarbonitrate or ammonium nitrate-fuel oil in the loading area, provided all necessary safety precautions are taken.
6. A copy of the general safety rules which the manufacturer will enforce, including plans for emergency procedures in the event of fire or explosion.

Plans of Plant

Sec. 77.402. A copy of the plans of the plant shall be kept in the office on the premises of each explosive, ammunition, blasting agents or fireworks manufacturing plant and shall be made available to the chief or his authorized representative upon request.

Training

Sec. 77.403. Workmen who handle explosives or explosive charges shall be instructed in the hazards of the materials and processes in which they are to be engaged and with the safety rules governing such materials and processes.

Emergency Procedure

Sec. 77.404. Emergency procedures shall be formulated for each plant which will include personal instruction in any emergency that may be anticipated. All personnel shall be made aware of an emergency warning signal.

Intraline Distance

Sec. 77.405. This distance is the minimum permitted between any two buildings within one operating line. Intraline distances are also used for separating certain specified areas, buildings and locations even though actual line operations are not involved. Intraline distance separation is expected to protect explosives in

buildings from propagation detonation due to blast effects but not against the possibility of propagation detonation due to fragments.

Intraline Separation of Operating Buildings

Sec. 77.406. (a) All mass detonating explosives Class A and fireworks manufacturing buildings, including those where explosive charges are assembled, manufactured, prepared or loaded, shall be separated from all other buildings, including magazines, within the confines of the manufacturing plant at a distance not 'less than those shown in the following Table No. 77.406 when the buildings are barricaded.

(b) When a building or magazine containing explosives is not barricaded, the intraline distances shown shall be doubled.

TABLE NO. 77.406-MINIMUM INTRALINE SEPARATION BETWEEN BARRICADED OPERATING BUILDINGS CONTAINING CLASS A EXPLOSIVES OR FIREWORKS MANUFACTURING

EXPLOSIVE OR FIREWORKS IN POUNDS		MINIMUM DISTANCE IN FEET	EXPLOSIVE OR FIREWORKS IN POUNDS		MINIMUM DISTANCE IN FEET
Over	Not Over		Over	Not Over	
	50	30	20,000	25,000	265
50	100	40	25,000	30,000	280
100	200	50	30,000	35,000	295
200	300	60	35,000	40,000	310
300	400	65	40,000	45,000	320
400	500	70	45,000	50,000	330
500	600	75	50,000	55,000	340
600	700	80	55,000	60,000	350
700	800	85	60,000	65,000	360
800	900	90	65,000	70,000	370
900	1,000	95	70,000	75,000	385
1,000	1,500	105	75,000	80,000	390
1,500	2,000	115	80,000	85,000	395
2,000	3,000	130	85,000	90,000	400
3,000	4,000	140	90,000	95,000	410
4,000	5,000	150	95,000	100,000	415
5,000	6,000	160	100,000	125,000	450
6,000	7,000	170	125,000	150,000	475
7,000	8,000	180	150,000	175,000	500
8,000	9,000	190	175,000	200,000	525
9,000	10,000	200	200,000	225,000	550
10,000	15,000	225	225,000	250,000	575
15,000	20,000	245			

Operation-Buildings and Equipment

Sec. 77.407. (a) Operating buildings or rooms in which more than 50 pounds of explosives or fireworks are present at any time shall be constructed with at least one wall of explosion-relief type. The relief wall shall be placed so as to be of least hazard to workmen in adjacent buildings.

(b) When explosive venting is required, the venting area will be calculated on 1 square foot for each 35 cubic feet of building or room area.

(c) All rooms or buildings shall have adequate aisle space and at least two exits separated from each other by a distance equal to at least one fifth the perimeter of the room. Openings in fire walls shall be equipped with approved, self-closing fire doors. All exit doors shall open in the direction of exit travel and be equipped with panic hardware.

EXCEPTION: Cubicles 100 square feet or less and occupied by not more than two persons working within 12 feet of an unobstructed passageway may have one exit.

(d) All electrical 'wiring and equipment shall be acceptable for the hazard involved and installed in accordance with requirements for wiring and equipment in hazardous locations.

(e) Effective bonding and grounding means shall be provided to prevent accumulation of static charges where static charges are a hazard.

(f) Explosives dust shall not be exhausted to the atmosphere. Where vacuum dust-collection systems are used, they shall comply with the following requirements:

1. Adequate filters must be installed between the source vacuum and the point of pickup to prevent explosives from entering the vacuum pump or exhauster.

2. The explosive dust-collection system shall be designed to prevent pinch points-threaded fittings exposed to the hazardous dust and sharp turns, dead ends, pockets, etc. , in which explosives may lodge and accumulate outside the collecting chamber.

3. The entire vacuum collection system shall be made electrically continuous and be grounded to a maximum resistance of 5 ohms.

4. Chambers in which the dusts are collected shall not be located in the operating area unless adequate shields for the maximum quantity of material in the collector are furnished for personal protection.

EXCEPTION: Wet-dust-type collectors.

5. More than two rooms may not be serviced by a common connection to a vacuum collection chamber. Where interconnections are used, means shall be employed to prevent propagation of an incident by way of the collection piping.

6. When collecting the more sensitive explosives such as black powder, lead azide or other high-energy materials, a "wet" collector which moistens the dust close to the point of intake and maintains the dust wet until removed for disposal shall be used. Wetting agents shall be compatible with the explosives.

7. Explosive dusts shall be removed from the collection chamber as often as necessary to prevent overloading. The entire system shall be cleaned at a frequency that will eliminate hazardous concentrations of explosive dusts in pipes, tubing, and/or ducts.

(g) Squirrel cage blowers shall not be used for exhausting hazardous fumes, vapors or gases. Only nonferrous fan blades shall be used for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

(h) Work stations for small amounts of explosives (less than one pound) shall be separated by distance, barrier or other means so that fire in one station will not

ignite material in the next work station. When necessary, each operator shall be protected by a personnel shield located between the operator and the explosive device or explosive material being processed. This shield and its support shall be a tested design to withstand a blast from the maximum amount of explosives allowed behind it.

Explosive Operations

Sec. 77.408. (a) When the type of material and processing warrants, mechanical operations involving explosives in excess of one pound shall be carried on at isolated stations or at intraline distances, and machinery shall be controlled from remote locations behind substantial barricades or at intraline separations so that workmen may remain at a safe distance while machinery is operating.

(b) The working area where the screening, grinding, blending and other processing of static-sensitive explosives or pyrotechnic materials is done shall be maintained above 20 percent relative humidity. If the relative humidity drops below 20 percent, the above operations shall be stopped and secured until the relative humidity can be raised above 20 percent. It is desirable to keep the relative humidity above 20 to 30 percent, except where metal powders are involved, and then the relative humidity shall be between 50 and 60 percent.

(c) Means shall be provided and used to discharge static electricity from hand trucks, buggies and similar equipment before they enter buildings containing static-sensitive explosives. It is recommended that conductive wheels, including metal wheels which could not cause sparks, be used on such equipment.

(d) Bulk explosives shall be kept in covered containers when not being used or processed. Explosives shall not be stored or transported in open containers.

(e) The quantity of explosive materials at any particular work station shall be limited to that posted on the load limit signs, and not to exceed four hours' supply of material or four hours' supply of product, except that when this quantity would introduce a serious hazard, such quantities shall be limited to a lesser amount.

(f) Appropriate receptacles with covers shall be provided for each station for disposing of waste material and debris. These waste receptacles shall be emptied and cleaned as often as necessary but not less than once each day or at the end of each shift.

(g) General safety rules and operating instructions governing the particular operation or process carried on at that location shall be available at each station. The rules shall include requirements for bonding and grounding, permissible cleaning agents to use and other precautions deemed necessary for safe operation.

(h) Personnel and explosive limits shall be posted.

(i) Regular maintenance and repair work shall not be permitted in an explosive building until explosives are removed and the area is made safe. This does not prohibit minor adjustments or emergency repairs to secure immediate safety.

(j) Spilled or dropped explosives shall be cleaned up at once.

(k) Shipping containers, cleaning rags and other materials contaminated with explosives shall be removed daily and disposed of in a safe manner.

(1) Fireworks. explosives or explosive charges shall not be stored near any source of heat.

Location of Explosive Detonations for Testing

Sec. 77.409. (a) Detonation or ignition of explosive charges or fireworks for testing shall be done only in a location so isolated by distance in accordance with the Quantity and Distance Table No. 77.201, or where barriers shall be provided that will protect any person connected with the test.

(b) Adequate shelter or distance shall be provided to protect employees detonating explosives.

(c) When tests are being conducted or explosives are being detonated, only authorized persons shall be present. Areas where explosives are regularly or frequently detonated or burned shall be fenced and posted with adequate warning signs. Adequate warning devices shall be used before burning or detonating explosives to warn persons who might approach from any direction that they are approaching a danger zone.

Disposal of Waste Explosives and Fireworks

Sec. 77.410. (a) Sites for destruction of explosives shall be located at the maximum practicable safe distance from inhabited buildings, public highways, operating buildings and all other exposures. The separation shall be not less than the inhabited building distance (see Table No. 77.201). When possible, barricades shall be utilized between the site and inhabited buildings.

(b) Provision shall be made so scrap explosive material will not be placed in any burn location until at least 48 hours after the last fires have gone out.

(c) A blasting shelter shall be provided near the burn area for emergency use.

ARTICLE 80
HAZARDOUS MATERIALS

Scope

Sec. 80.101. This article shall apply to materials not otherwise covered in this code which are highly flammable, or which may react to cause fires or explosions, or which by their presence create or augment a fire or explosion hazard, or which because of the toxicity, flmmability or liability to explosion render fire fighting abnormally dangerous or difficult; also to flammable or combustible liquids which are chemically unstable and which may spontaneously form explosive compounds or undergo spontaneous reactions of explosive violence or with sufficient evolution of heat to be a fire hazard. Hazardous materials shall include such materials as flammable solids, corrosive liquids, poisonous gases or highly toxic, radioactive, oxidizing, unstable or reactive, hypergolic or pyrophoric as defined in Article 9. Also, any substance or mixture of substances which is an irritant, a strong sensitizer, or which generates pressure through exposure to heat, decomposition or other means.

Permits

Sec. 80.102. For a permit to store, transport on site or use corrosive liquids, oxidizing materials, organic peroxides, nitromethane, ammonium nitrate, ammonium nitrate fertilizers and fertilizer mixtures, highly toxic materials, pyrophoric materials, hypergolic materials, cryogenic materials) poisonous gases or hazardous materials, see Section 4.101.

For a permit to store, handle or use radioactive material, see Section 4.101.

All hazardous materials permits shall be posted in a conspicuous location on the premises.

General Requirements

Sec. 80.103. (a) The manufacture, storage, on-site transportation or use of hazardous materials shall be safeguarded with such protective facilities as public safety requires.

(b) The chief may require the following:

1. The separation or isolation of any material that in combination with other substances may bring about a fire or explosion or may liberate a flammable or poisonous gas.
2. The separation of occupancies or buildings from other storage when the quantity stored constitutes a fire or life hazard.

(c) Defective containers which permit leakage or spillage shall be disposed of or repaired in accordance with recognized safe practices; no spilled material shall be allowed to accumulate on floors or shelves.

(d) Where kept for retail sale in containers or packages usual to the retail trade, storage shall be neat and orderly and shelves shall be of substantial construction.

(e) Where specific requirements are not otherwise established, storage, transportation or use of hazardous materials shall be in accordance with nationally recognized standards or good practices.

(f) Visible hazard identification signs as specified in U.F. C . Standard No .79-3 shall be placed at all entrances to and in locations where hazardous materials are stored, handled or used in quantities requiring a permit.

(g) Satisfactory provisions shall be made for containing or neutralizing spills or leakage of hazardous materials which may occur during storage, handling, transportation or use .

(h) Materials safety data sheets shall be readily available for all hazardous materials on the premises.

(i) For storage cabinet, transportation and storage tank requirements, see Sections 80.109,80.110 and 80.111 .

Oxidizing Materials

Sec. 80.104. (a) Oxidizing materials shall be stored in cool, ventilated, dry locations and separated from organic materials. Bulk oxidizing materials shall not be stored on or against combustible surfaces.

(b) Oxidizing materials shall be stored separately from flammable liquids, flammable solids , combustible materials) hazardous chemicals, corrosive liquids and such other noncompatible materials as may be determined by the chief.

Radioactive Materials

Sec. 80.105. (a) Durable, clearly visible signs of warning of radiation dangers shall be placed at all entrances to areas or rooms where radioactive materials are used or stored. In addition, each container in which radioactive materials are used, stored or transported shall bear a durable, clearly visible, appropriate warning sign. Such signs shall bear the three-bladed radiation symbol in magenta or purple on a yellow background in accordance with nationally recognized good practice.

(b) Signs are not required for storage of manufactured articles other than liquids, such as instruments or clock dials or electronic tubes or apparatus of which radioactive materials are a component part, and luminous compounds, when securely packed in strong containers, provided the gamma radiation at any surface of the package is less than 10 milliroentgens in 24 hours.

(c) When not in use, radioactive materials shall be kept in adequately shielded fire-resistant containers of such design that the gamma radiation will not exceed 200 milliroentgens per hour or equivalent at any point of readily accessible surface.

Reactive and Unstable Materials

Sec. 80.106; (a) **General.** Reactive and unstable materials shall be kept apart from open flames, excessive heat and other potential ignition sources. Storage shall be controlled to prevent excessive temperatures and pressures and to prevent contamination. Uncontaminated content of broken or cracked bags, packages or other containers shall be transferred to new and clean containers before storing. Other spilled materials and discarded containers shall be promptly gathered up and destroyed in an approved manner. Internal combustion motor vehicles or lift trucks shall not be parked or stored in a room or compartment where such

materials are located. Electrical equipment shall conform to the requirements of the Electrical Code.

(b) **Organic Peroxides.** A detached, well-isolated, ventilated and unheated storage building with walls having not less than a two-hour fire-resistive rating constructed in accordance with the Building Code, a noncombustible floor and a lightweight insulated roof shall be provided for the storage of 50 pounds or more of organic peroxides. If not adequately protected by a fast-acting deluge-type automatic sprinkler system, the storage building shall be located the following minimum distances from flammable or combustible liquid storage, combustible materials in the open and from any other building or highway.

WEIGHT OF ORGANIC PEROXIDE (Pounds Over) (Pounds Not Over)	DISTANCE (Feet)
50 to 100	75
100 to 500	100
500 to 1000	125
1000 to 3000	200
3000 to 5000	300

The organic peroxides shall be stored in the original shipping containers (ICC containers). Care shall be taken to avoid rough handling or contamination of these chemicals. Readily legible warning signs and placards shall be prominently placed in the storage and processing areas.

(c) Nitromethane. A suitably isolated outdoor storage area shall be provided for nitromethane, Hazardous processing shall not be permitted in the vicinity of this storage area. Nitromethane shall be stored in the drums in which it is received or in an underground tank with suitable corrosion protection and a minimum of 2 feet of earth over the tank or in barricaded tanks aboveground. If the drum storage is not adequately protected by a fast-acting deluge-type automatic sprinkler system, the storage of 2000 pounds or more shall be located the following minimum distances from inhabited buildings:

WEIGHT (Pounds Over) (Pounds Not Over)	APPROXIMATE NUMBER OF DRUMS	DISTANCE (Feet)
Beginning at 2000	4	100
2000 to 10,000	20	200
10,000 to 20,000	40	300
20,000 to 40,000	80	400
40,000 to 80,000	160	500

Care shall be taken to avoid rough handling or contamination of this chemical. Readily legible warning signs and placards shall be prominently placed in the storage and processing areas.

(d) **Ammonium Nitrate.** 1. All flooring in storage and handling areas shall be of noncombustible material and shall be without drains, traps, pits or pockets into which any molten ammonium nitrate could flow and be confined in case of fire.

2. Each storage pile of bags or other authorized packages and containers of such materials shall not exceed 12 feet in height, 12 feet in width and 30 feet in length. Such ,pile units shall be separated by a clear space of not less than 36 inches in width from the base to the top of the piles, serving as cross aisles. At least one service or main aisle in the storage area shall be not less than 4 feet in width. A clearance of not less than 30 inches shall be maintained from building walls and partitions and of not less than 36 inches from ceilings or roof structural members with a minimum of 18 inches from sprinklers.

3. Ammonium nitrate storage areas shall be separated by a space of 30 feet or by a tight noncombustible partition from storages of organic chemicals, corrosive liquids, compressed gases, flammable and combustible materials or other contaminating substances such as sulphur, coal, flour and metallic powders such as zinc, copper and magnesium where storage of such materials is permitted with ammonium nitrate.

4. Quantities of ammonium nitrate or ammonium nitrate fertilizer having no organic coating, in the form of crystals, flakes, grains or pills, including fertilizer grade, dynamite grade, nitrous oxide grade and technical grade ammonium nitrate and ammonium nitrate phosphate (containing 60 percent or more ammonium nitrate by weight) of more than 50 tons total weight shall be stored in a well-ventilated building. Such building shall be of one-hour fire-resistive or noncombustible construction as specified in the Building Code or shall be equipped with an approved automatic sprinkler system. In populated areas, quantities of 2500 tons or more shall be stored in well-ventilated buildings of one-hour fire-resistive or noncombustible construction as specified in the Building Code, equipped with an approved automatic sprinkler system. No combustible materials or ammonium nitrate sensitizing contaminants shall be stored in this building.

5. Storage of ammonium nitrate, coated or mixed with organic anticaking materials, except compounded blasting agents, shall not be permitted in populated and congested areas. Outside such areas, quantities of 500 tons or less may be stored in well-ventilated buildings of one-hour fire-resistive or noncombustible construction as specified in the Building Code, equipped with an approved automatic sprinkler system.

Highly Toxic Materials

Sec. 80.107. (a) Highly toxic materials shall be segregated from other chemicals and combustible and flammable substances by storage out of doors or in a room or compartment separated from other areas by a one-hour occupancy separation constructed as specified in the Building Code. The storage room shall be provided with adequate drainage facilities and natural or mechanical ventilation to the outside atmosphere constructed as specified in the Mechanical Code.

EXCEPTION: Approved storage cabinets for hazardous materials may be used for limited amounts approved by the chief.

(b) Highly toxic materials shall be segregated from other chemicals and combustible and flammable substances by storage in a room or compartment separated from other areas by a one-hour occupancy separation constructed as specified in the Building Code. The storage room shall be provided with adequate drainage facilities and natural or mechanical ventilation to the outside atmosphere constructed as specified in the Mechanical Code.

(c) Legible warning signs and placards stating the nature and location of the highly toxic materials shall be posted at all entrances to areas where such materials are stored or used.

Poisonous Gases

Sec. 80.108. (a) Storage of poisionous gases shall be in rooms of at least one-hour fire-resistive construction as specified in the Building Code and having natural or mechanical ventilation adequate to remove leaking gas. Such ventilation shall not discharge to a point where the gases may endanger any person, domestic animal or wildlife.

EXCEPTION: Poisonous gases may be stored or used in a room without one-hour fire-resistive construction and mechanical ventilation, provided:

1. Two approved self-contained breathing apparatus units are provided in the immediate area.
2. Atmosphere is monitored and an audible and visual alarm is activated when the maximum safe level for long-term exposure is reached.
3. Excess flow control is provided at the bulk source.
4. Emergency shutdown controls are provided internal and external to the area of use.
5. Approved gas cylinder cabinets which provide adequate ventilation and fire protection are utilized.

(b) Legible warning signs stating the nature of hazard shall be placed at all entrances to locations where poisonous gases are stored or used.

Storage Cabinets for Hazardous Materials

Sec. 80.109. Cabinets for the storage of hazardous materials shall be of approved substantial construction and of 0.0478-inch steel or a minimum of l-inch plywood or equivalent which is compatible with the material being stored. Doors shall be self-closing and self-latching. A minimum of 2-inch sill shall be provided and cabinets shall be liquid tight to the top of the sill. Cabinets shall be painted with an intumescent-type paint and shall be conspicuously labeled in red letters on contrasting background HAZARDOUS—KEEP FIRE AWAY and with hazard identification in accordance with U.F.C. Standard No. 79-3.

Designation of Cargo

Sec. 80.110. No person shall operate any vehicle transporting any hazardous materials unless at the time of such transportation there are affixed to both sides, the front and the rear of the vehicle placards and identification numbers in conformity with Title 49, Code of Federal Regulations, 1981.

Aboveground Storage Tanks and Pressure Vessels

Sec. 80.111. (a) All aboveground storage tanks, pressure vessels and con-

tainers over 100 gallons (water capacity) permanently installed, mounted or affixed and used for the storage of flammable and combustible liquids, compressed gases, or hazardous chemicals regulated by this article, shall be identified in accordance with U.F.C. Standard No. 79-3

EXCEPTION: Portable tanks not permanently mounted, temporary tanks used on construction sites, drum storage and packaged materials in containers of 55 gallon or less capacity.

Labels shall conform with U.F.C. Standard No. 79-3 for size and color and shall be affixed to tank, vessel or container so as to be conspicuously visible at all times.

(b) When any tank covered in this section is housed within a building, the building shall have the same hazard identification label in a conspicuous location on the exterior of the building.

Appendix E (cont'd)

Permit Used by City of Kansas City
at Time of Explosion

City of Kansas City, Missouri
Public Works Department
Office of the City Engineer
Permit for Blasting

No. _____ Expiration Date: December 31, 19-

A Permit is hereby requested by _____

_____ Job Site Phone, _____

to use high explosives for blasting purposes in connection with work at _____

_____

the said _____ having forwarded an approved bond issued by

_____

dated _____ in the sum of _____

_____ Dollars.

CITY CONTRACT NUMBER _____ DEPARTMENT _____

We are familiar with the use of explosives for the purpose of construction or demolition and are also fully informed on the best safety practices in connection with the use of this material.

_____

BY _____

This permit is limited to blasting at the particular location stated above and is issued pursuant to Sections 14. 33, 14.34, 14.35, 14.36, 14.37, 14.38, 14.39, 14.40, 14.41 and 14.42 of the Code of General Ordinances adopted January 23, 1973. Unless revoked by the City Engineer, this permit is valid until the expiration date above or the completion of the project, whichever occurs sooner.

Blasting will be done under the supervision of City Engineer -

Yes — No _____

Date _____ Approved by: _____

City Engineer

Appendix F

Kansas City Attorney's Opinion
Regarding Permits and Inspections

Inter-Departmental Communication

DATE December 6, 1988

TO David Olson, City Manager

FROM Richard Ward, City Attorney

SUBJECT Highway Commission Jurisdiction

We have been researching the Missouri Constitution laws and cases concerning the control of the Missouri Highway and Transportation Commission over State Highway projects on State right of way or state controlled property. It is our opinion that based on the provisions of Article IV, Section 29 of the Missouri Constitution and Section 227.030, RSMo. (1986) that this control is exclusive and the City has no rights whatsoever to enforce its code on the Commission or its contractors.

Therefore, we should not issue any permits or do any construction inspection or supervision on the projects. This will all be handled by the Missouri Highway and Transportation Commission.

Richard Ward
City Attorney

RNW:tl

Appendix G

Examples of Kansas City Blasting Permit Job Site Description, Plot Diagram, and Approval Form

LOCATION/NAME OF **JOB/NAME OF SITE**

EXPLOSIVES ON SITE: YES

AMOUNT: 40,000 AMMONIUM NITRATE
30 CASES DYNAMITE

TYPE:

ANFO

MATERIAL SAFETY DATA SHEET **"MSDA"**
GET **A** COPY OF THIS **FORM.**

STORAGE: IS IT TEMPORARY **OR** (PERMANENT.)

TYPE: MAG + STORAGE TRAILER

LOCATION: ON SITE - IN MINE.

HOW IS IT STORED: MAG -- SEMI TRAILERS

AMOUNTS:

AREA POSTED: BLASTING AREA.

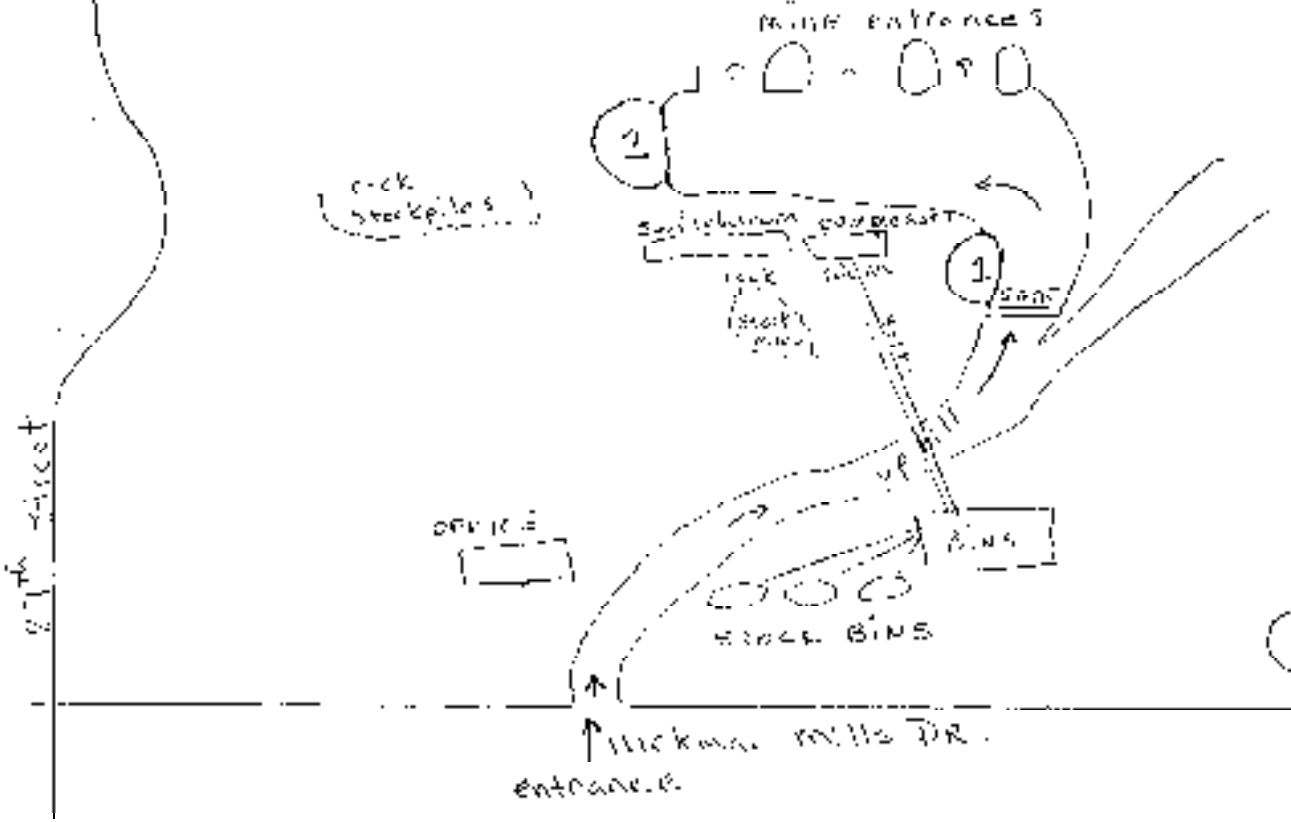
STORAGE CONTAINER MARKED: NO

435 Hwy

EAST

#1 - detonators

#2 - explosives



DATE _____

To _____

FROM _____

SUBJECT Blasting Site Approval by Fire Marshal's Office

The below listed Company and location has been approved by the Fire Marshal's Office as an approved blasting site.

COMPANY'S NAME _____

BLASTING SITE ADDRESS _____

_____

Fire Marshal's Inspector
Bureau of Fire Prevention

Appendix H

Type 5 Magazine Storage Requirements
and Construction Exhibits

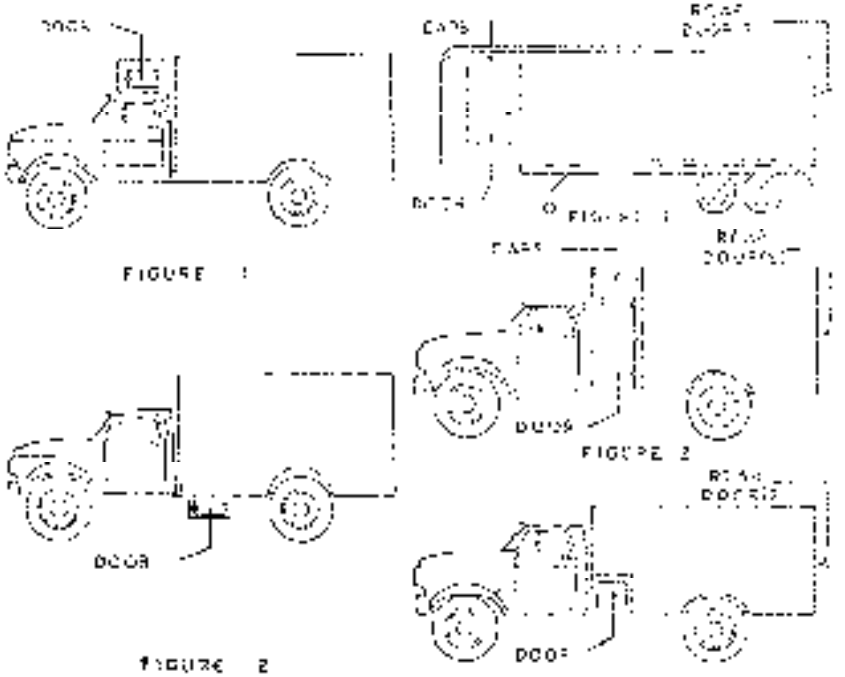
Type 5 Storage

A Type 5 storage facility may be a building, an igloo or Amy-type structure, a tunnel, a digout, a bin, a box, a trailer, or a semitrailer or, other mobile facility; and shall be theft-resistant.

Item	Requirements
Doors or Covers	Shall be constructed of either solid wood, or Metal.
Hinges, Hasps, and Locks	See construction requirements common to all types of storage facilities.
Housekeeping	See common requirements.
Restrictions On Type 5 Outdoor Storage Facilities	
Ground	Ground around storage facility shall slope away for drainage.
Unessential Storage	Unattended motor vehicles or mobile equipment shall have wheels removed or shall be immobilized by locking the steering devices.
Restrictions On Type 5 Indoor Storage Facilities	
Location	No indoor storage facility for storing of explosive agents shall be located in a residence or dwelling.

EXHIBIT "A"

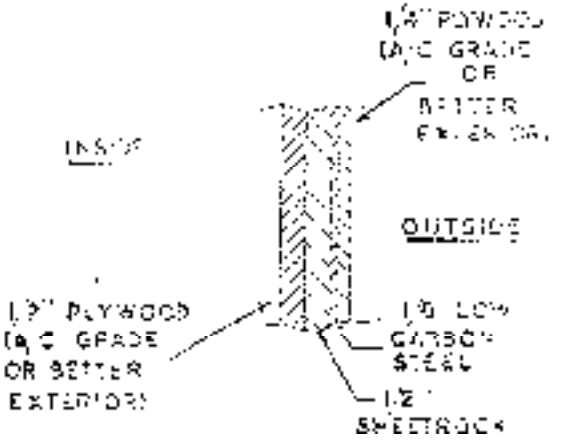
PERMANENTLTY MOUNTED CONTAINERS



NOTE. THE CONFIGURATIONS SHOWN IN FIGURES I AND2 ARE EQUALLY APPLICABLE TO MULTI-AXLE AND "CAB-OVER" VEHICLES

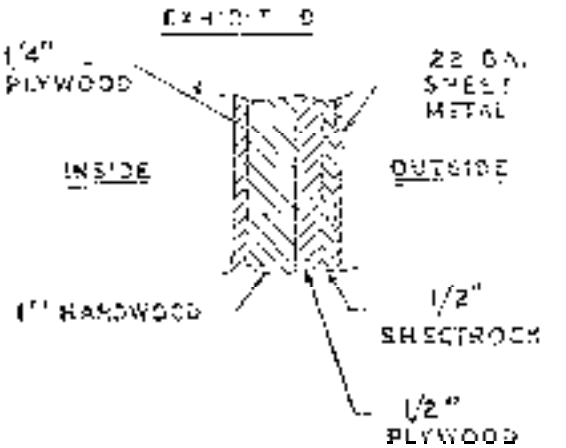
NOTE : THE CONFIGURATIONS SHOWN IN FIGURE 2 AND, 3 ARE EQUALLY APPLICABLE TO MULTI-AXLE AND "CAB-OVER" VEHICLE.

EXHIBIT



SKETCH OF LAMINATE CONSTRUCTION FOR CONTAINER OR COMPARTMENT FOR E.B. CAPS, USE AS ILLUSTRATED IN EXHIBIT A, B, AND E

EXHIBIT B



SKETCH OF LAMINATE CONSTRUCTION FOR CONTAINER FOR E.B CAPS RESTRICTED TO USE AS ILLUSTRATED IN EXHIBIT A.

Exhibits A-D
Ruling 77-24

Appendix I

Excerpt from NFPA 495

3-4.5 Any electrically driven conveyors for loading or unloading bins shall comply with the requirements of NFPA 70, *National Electrical Code*. They shall be designed to minimize damage from corrosion.

3-4.6 Bins containing blasting agents shall be located in accordance with Table 6-4b with respect to inhabited buildings, passenger railroads, and public highways.

3-4.7 Bins containing blasting agents shall be located in accordance with Tables 6-4b and 6-4c with respect to the storage of other blasting agents or explosives.

3-4.8 Bins containing ammonium nitrate shall be separated from storage of blasting agents and explosives in accordance with Table 6-4c.

3-4.9 Good housekeeping shall be maintained around any bin containing ammonium nitrate or blasting agent. This shall include keeping weeds and other combustible materials cleared within 25 ft (7.5) m) of the bin. Accumulations of spilled product shall be prevented.

3-5 Storage of Blasting Agents and Supplies.

S-5.1 Blasting agents and oxidizers used for mixing of blasting agents shall be stored according to the following requirements:

(a) Blasting agents or ammonium nitrate stored with other explosive materials shall be stored according to the requirements of Chapter 3. The total mass of the blasting agents and one-half the mass of ammonium nitrate shall be included when computing the total quantity of explosive materials for determining separation distance requirements.

(b) Blasting agents stored entirely separate from other explosive materials shall be stored in a Type 5 magazine or a magazine of higher classification (lower number).

(c) Magazines in which blasting agents are stored shall be constructed so that there are no open floor drains or piping into which molten materials may flow and be confined in case of fire.

(d) Semi-trailer and trailer vans used for highway or on-site transportation of blasting agents are satisfactory for temporary storage, provided they are located in ace cordance with Table 6.4b with respect to inhabited buildings, passenger railways, and public highways, and with Table 6.4c with respect to each other. Trailers and semi-trailers shall be provided with substantial means for locking and the doors shall be kept locked unless stocks of blasting agents are actually being placed or removed.

3-5.2 Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be adequately separated from readily combustible fuels.

3-5.3 Caked oxidizer, either in bags or in bulk, shall not be loosened by blasting.

3-5.4 Every magazine used for the storage of blasting agents shall be under the supervision of a competent person who shall be at ***least*** 21 years of age.

3-6 Transportation of Packaged Blasting Agents.

3-6.1 When blasting agents are transported in the same vehicle with other explosive materials, all of the re. quirements of Chapter 5 shall be met.

3-6.2 Vehicles transporting blasting agents shall only be driven by and be in charge of a driver at least 21 years of age who is capable, careful, reliable, and possessing a valid motor vehicle operator's license. This person shall also be familiar with state vehicle and traffic laws.

3-6.3 No matches, firearms, acids, or other corrosive liquids shall be carried in the bed or body of any vehicle carrying blasting agents.

3-6.4 No person shall be permitted to ride upon. drive, load, or unload a vehicle containing blasting agents while smoking or while under the influence of intoxicants, narcotics, or other dangerous drugs.

3-6.5 It is forbidden for any person to transport or carry any blasting agents upon any public vehicle carrying passengers for hire.

S-6.6 Vehicles transporting blasting agents shall be in safe operating condition at all times.

3-6.7 When blasting agents are transported over public highways, the packaging, marking, and labeling of containers of blasting agents shall comply with U.S. Department of Transportation regulations.

3-6.8 Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with U.S. Department of Transportation regulations.

3-7 Use of Blasting Agents. Persons using blasting agents shall comply with all applicable requirements of Chapters 2 and 7 of this Code.

Chapter 4 Water Gel and Emulsion Explosive Material

4-1 Scope. For the purposes of this chapter, the term water gel means water gel explosive material or emulsion explosive materials.

4-2 Types and Classifications. Water gels shall be classified as Class A or Class B explosives or as Blasting Agents, according to U.S. Department of Transportation regulations. They shall be manufactured, transported, stored, and used as specified by this Code.

Exception: As otherwise provided for in this chapter.

4-3 Fixed Location Mixing.

4-3.1 Buildings or other facilities used for mixing water gels shall be located according to Table 6-4b with respect to inhabited buildings, passenger railways, and public highways.

In determining the distances separating highways, railroads, and inhabited buildings from potential explo-

Notes to Table of Recommended Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents

NOTE I: Recommended separation distances to prevent ex. plosion of ammonium nitrate and ammonium nitrate based blasting agents by propagation from nearby scores of high ex. plosives or blasting agents referred to In the Table as the "donor." Ammonium nitrate by Itself. IS not considered to be a donor when applying this Table. Ammonium nitrate, am. monium nitrate.fuel oil or combinations thereof are acceptors. If stores of ammonium nitrate are located wtthin the sym. pathetic detonation distance of explosives or blasting agents, one-half the mass of the ammonium nitrate should be included in the mass of the donor.

NOTE 2: When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the Table shall be multiplied by six. These distances allow for the possibility of high velocity metal fragments from mixers. hoppers, truck bodies. sheet metal structures. metal containers. and the like, which may enclose the "donor." Where storage is in bullet resistant magazines' recommended for explosives or where the storage is protected by a bullet resistant wall. distances and barricade thicknesses in excess of those prescribed in the American Table of Distances are not required.

NOTE 3: The distances in the Table apply to ammonium nitrate that pass" the insensitivity test prescribed in the defini. cion of ammonium nitrate fertilizer promulgated by the Fer. tilizer Institute and ammonium nitrate failing to pass said test shall be scored at separation distances determined by competent persons and approved by the authority having jurisdiction.

NOTE 4: These distances apply to nitrocarbonitrates and blasting agents which pass the insensitivity test prescribed in regulations of the U.S. Department of Transportation and the U.S. Department of the Treasury. Bureau of Alcohol. Tobacco and Firearms.

NOTE 5: Earth, or sand dikes, or enclosures filled with the prescribed minimum thickness of earth or sand are acceptable artificial barricades Natural barricades such as hills or timber of sufficient density that the surrounding exposures which re. quire protection cannot be seen from the "donor" when the trees are bare of leaves, are also acceptable.

NOTE 6: For determining the distances to be maintained from inhabited buildings. passenger railways and public highways. UK the Table of Distances for Storage of Explosives. Table 6.4b.

64.4 An indoor magazine shall only be located on a floor that has an entrance at or a ramp to grade level. It shall be located no more than 10 ft (3 m) from the entrance.

64.5 Two magazines may be located in the same building only if one magazine is used solely for the storage of detonators in quantities not exceeding 5,000. A distance of 10 ft (3 m) shall be maintained between the magazines.

6-4.6 The local tire department and ocher local emergency response agencies shall be notified of the location of all magazines and shall be notified of any changes in location.[3]

64.7 Type 3 magazines shall be located away from neighboring inhabited buildings, railways, highways, and other magazines. A distance of 150 ft (45.8 m), or greater if required by the local authority having jurisdiction, shall be maintained between magazines and work in progress whenever the quantity of explosives in the magazines exceeds 25 lb (11.3 kg).

6-4.7.1 The separation distance between magazines and work in progress may be reduced to SO ft (15.24 m) if the quantity of explosive materials in the magazines does not exceed 25 lb (11. S kg).

6-4.8 Type S magazines shall be attended when exe plosive materials are stored within. All explosive materials shall be removed to appropriate storage magazines for unattended storage at the end of the work day.

6-4.9 Two Type 3 magazine may be located at a blasting site, if one magazine is used solely for the storage of detonators.

6-4.10 A Type 5 magazine shall not be located in a residence or dwelling.

6-5 **Magazine Construction - Basic Requirements.**

6-5.1 Magazines shall be constructed so as to comply with this section or in a manner substantially equivalent to the requirements for safety and security embodied in this section.

6-5.2 The ground around a magazine shall be graded so that water drams away from the magazine.

6-5.3 Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building or by indirect warm air heating.

6-5.3.1 Indirect warm air shall be heated by either hoc water or low pressure [15 psig (103 kPa) or less] steam coils located outside the magazine building.

6-5.4 Magazine heating systems shall meet the following requirements:

(a) Radiant heating coils within the building shall be installed so that explosive materials or their containers cannot contact the coils and so that air is free to circulate between the coils and the explosive materials. The sur. face temperature of the coils shall not exceed 165°F *(74%)*.

(b) Heating ducts shall be installed so that the hot air /discharged from the ducts is not directed against ex. plosive materials or containers.

(c) The heating system shall be controlled so that the ambient temperature of the magazine does not exceed 130°F (54°C).

(d) Any electric fan or pump used in the heating system shall be located outside the magazine, separate from the magazine walls, and shall be grounded.

(e) Any electric motor and any controls for electric heating devices used to heat water or produce steam shall have overload devices and disconnects which comply with NFPA 70, National Electrical *Code,* All electrical switch. gear shall be located at least 25 ft (7.6 m) from the magazine.

(f) Any fuel-fired heating source for the hot water or steam shall be separated from the magazine by a distance

For construction of bullet resistant magazines see Section 6.6.

'Definition *and Test Procedures for Ammonium Nitrate Fertilizer.* Fertilizer Institute November 1964.

container without a closed lid may be stored in the magazine. Only fiberboard containers may be opened in the magazine.

6-7.9 Containers of explosive materials other than fiberboard shall not be unpacked or repacked inside or within 50 ft (15.25 m) of a magazine or in close proximity to other explosive materials.

6-7.10 Tools used for opening containers of explosive materials shall be constructed of nonsparking material.

Exception: Metal slitters may be used/or opening fiberboard containers.

6-7.11 Magazines shall be used exclusively for the storage of explosive materials, blasting materials, and blasting accessories. Metal tools other than nonferrous transfer conveyors shall not be stored in a magazine containing explosives or detonators. Ferrous metal conveyor stands protected by a coat of paint may be stored within a magazine.

6-7.12 Magazine floors shall be regularly swept and kep clean, dry, free of grit, paper, empty packages, and ru rubbish. Brooms and other cleaning utensils shall not have any s spark-producing metal parts. Sweepings from magazine floors shall be disposed of according to manufacturers' instructions.

6-7.13 When any explosive material has deteriorated to the extent that it is in an unstable or dangerous condition or if nitroglycerine or other liquid is leaking from any explosive, the person responsible for the explosives shall immediately contact the manufacturer for assistance. Magazine floors stained with nitroglycerine or other liquid shall be cleaned according to manufacturers' instructions.

67.14 Before making repairs to the interior of a magazine, all explosive materials shall be removed and the floor shall be cleaned.

67.15 In making repairs that may result in sparks or fire to the exterior of a magazine, all explosive materials shall be removed.

67.16 Explosive materials removed from a magazine undergoing repair shall be placed either in another magazine or at a safe distance from the magazine. They shall be properly guarded and protected. Upon completion of the repairs, they shall be promptly returned to the magazine.

6-8 Miscellaneous Safety Precautions.

68.1 Smoking, matches, open flames. spark-producing devices, and firearms shall not be permitted inside of or within 50 ft (15.25 m) of a magazine.

Exception: *Firearms carried by authorized guards.*

6-8.2 The area around a magazine shall be kept clear of brush, dried grass, leaves, and similar combustibles for a distance of at least 25 ft (7.63 m).

6-8.3 Combustible materials shall not be stored within 50 ft (15.25 m) of magazines.

6-8.4 Explosive materials recovered from blasting misfires shall be stored in a separate magazine until disposal instructions have been received from the manufacturer. Such explosive materials shall then be disposed of in the manner recommended. Detonators recovered from blasting misfires shall not be reused.

6-8.5 Property on which Type 1 magazines and outdoor magazines of types 2, 4 and 5 are located shall be posted; shall be located so as to minimize the possibility that a bullet shot at the sign will hit the magazine.

Chapter 7 Use of Explosive Materials for Blasting

7-l Basic Requirements.

7-1.1 All federal, state, and local laws and regulations applicable to obtaining, owning, transporting, storing, handling, and using explosive materials shall be followed.

7-1.2 Explosive materials shall be protected from unauthorized possession and shall not be abandoned.

7-1.3 Explosive materials shall be used only by experi. enced persons who are familiar with the hazards involved and who hold all required permits.

7-1.3.1 Loading and Firing shall be performed or supervised only by a person possessing an appropriate blaster's permit.

7-1.3.2 Trainees, helpers. and other persons who do not hold the required permits shall work only under the supervision of persons holding such permits.

7-1.4 No explosive materials shall be located or stored where they may be exposed to flame, excessive heat, sparks, or impact.

7-1.4.1 No firearms shall be discharged into or in the vicinity of a vehicle containing explosive materials or into or in the vicinity **of** a location where explosive materials are being handled, used, or stored.

7-1.4.2 No smoking shall be permitted within 50 ft (15.25m) or used any location where explosives are being han-

7-1.4.3 No person within 50 ft (15.25 m) of any location where explosives are being handled or used shall carry any matches, open light, or other fire or flame.

Exception: Suitable devices for lighting safety fuse are exempt from this requirement.

7-1.5 No person under the influence of intoxicating liquors, narcotics, or other dangerous drugs shall be allowed to handle explosive materials.

7-1.6 No attempt shall be made to fight a fire which cannot be contained or controlled before it reaches explosive materials. In such cases, all personnel shall be im-

Appendix J

Excerpts from National Fire Academy Course Materials

SCOPE OF THE COURSE

Recognizing and Identifying Hazardous Materials is designed to enable the student to contribute to the reduction of the harm created by hazardous materials emergencies. The course is designed to develop the basic skills with which to:

- identify the hazardous materials problem in their communities;
- recognize hazardous materials presence;
- identify the specific hazardous material(s) and associated hazard characteristics.

COURSE GOAL AND OBJECTIVES

The overall course goal is to provide the student with the knowledge to recognize and identify hazardous mater&. Specific objectives which lead to this goal are to:

- determine the extent of the hazardous materials potential in their community;
- describe the types of problems associated with emergencies involving hazardous materials;
- explain the function of emergency response personnel in hazardous materials emergencies;
- list and explain the six steps of Benner's D.E.C.I.D.E. process;
- list and explain the SIX clues for detecting hazardous materials presence;
- name the shipping papers found in transportation by proper name, location, and person responsible for the document;
- describe the information and assistance available from the following resources and how to obtain this information and assistance -
  a. CHEMTREC
  b. Shipper (Chemical Industry)
  c. Carrier (Transportation Industry)
  d. Federal agencies
  e. Various emergency action guides (particularly the DOT Emergency Response *Guidebook,* and the BOE *Emergency Handling of Hazardous Materials Surface Transportation.)*
- given a variety of emergency scenes, the appropriate documents, and other identified resource manuals -
  a. select the situation involving hazardous materials;
  b. identify the specific name of the material(s) involved; and
  c. develop and record the hazard and response information associated with that material.

STANDARDS

The National Fire Academy has long been a strong supporter of the standards-making process of the National Professional Qualifications Board for the Fire Service which operates under the jurisdiction of the Joint Council of National Fire Service Organizations.

The Academy, in its final preparation of this course, reviewed the appropriate professional qualifications standards to determine which specific standards were addressed in whole or in part.

Those addressed in whole or substantially in part are:

NFPA-1001 Firefighter Professional Qualifications (1981)

511.1	The firefighter shall define and identify the symbols and signs used to designate hazardous materials.
5-11.2	The firefighter shall define and identify the precautions to be observed and followed in hazardous material areas.

1109

To consider the harm associated with the release of harardous materials Let's look at some past releases and their effect on the community.

1110

In Waverly, Tennessee. a tram derailment resulted in the delayed but violent release of LP gas from a tank car.

1111

The resulting fire killed 16 people, injured 40, destroyed 30 buildings and caused the evacuation of more than 1,000 persons

1112

An air transportation incident at National Airport in Washington, D.C. involved a leaking container of viral hepatitus - an etiologic agent. Release of the contents could have had d major Impact on the people in the metropolitan Washington, D.C. area.

1113

In LaGrange, Missouri, a flaming barge carrying 840,000 gallons of gasoline ripped from itS moonings after a series of explosions at an oil refinery and drifted into a railway bridge down river at Quincy, Illinois, killing SIX people.

1114

In Rutt Creek, Pennsylvania a pipeline rupture released 75,000 gallons of propane, killing two people

1115

A truck driver in Marshalls Creek, Pennsylvania noticed a tire fire on his vehicle. removed the placards and then notified the fire department. When the firefighters arrived. they could not find the driver or see any indication of the vehicle's contents.

While attempting to extingulsh the fire, the contents - 13 tons of blasting agent - exploded. killing six firefighters and destroying their apparatus.

1116

Methyl bromide, a poisonous liquid, was released during this grade crossing accident It injured tour railroad employees

1117

A splash of sulfuric acid, d corrosive material, from d failed rupture disk on the safety vent on this tank car injured a railroad employer

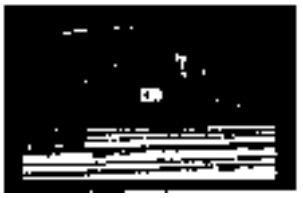
1118

Other accidents have been less costly in human terms. This leakage of liquetied petroleum gas through a valve was secured with no problems.

1029 Explosives and blasting agents are compounds mixtures, or devices designed to function with instantaneous release of heat and gas.

1030 Explosives are often sensitive to heat or shock Some react by contact with corrosive materials.

1031 Class “A” explosives are of detonating or otherwise maximum hazard.



1032 A detonation is characterized by the instantaneous release of energy and the flying pieces of the container.

1033 Dynamite and TNT are class “A” explosives because they detonate. Black powder is a class "A" explosive because it burns very rapidly, or deflagrates, when exposed to a spark or fire.

1034 Class "B" explosives like propellant explosives special Fireworks and rocket motors,, function by rapid combustion, rather than detonation

1035 Class “C” explosives, such as igniter cord. small arms ammunition, and common fireworks, are manufactured products which contain small quantltles of class “A” or “B” explosives. Their principle hazard IS fire.

1036 Blasting agents, like ammonium nitrate-fuel oil mixtures, function by detonation. However, they are so stable that there is little chance of an accidental explosion.

1037 Rail shipments of explosives are generally military ordinance packaged In wooden boxes and shlpped In box cars.

1038 For commercial products, fiberboard boxes are generally used.

TIME	CONTENT/METHODOLOGY	MATERIALS
5 min.	**STEP** 1 —Interactive Discussion— Purpose of the Emergency Response Effort	
	A. Develop the purpose of an emergency response effort.	
	IF HAZARDOUS MATERIAL EMERGENCIES DO OCCUR AND YOU, AS EMERGENCY RESPONSE PERSONNEL, GET INVOLVED, **WHAT IS THE PURPOSE OF YOUR EMERGENCY RESPONSE EFFORT?**	
	Let the students answer verbally. Discuss their answers and try to develop consensus.	
	Try to develop the following answer from the students' comments.	
	TO FAVORABLY CHANGE THE OUTCOME.	SM II-3
	REMEMBER, WE GET INVOLVED BECAUSE OF THE POTENTIALLY UNFAVORABLE/UNSATISFACTORY OUTCOMES ASSOCIATED WITH HAZARDOUS MATERIALS. **IF WE CAN'T FAVORABLY CHANGE THE OUTCOME, WHY EVEN GET INVOLVED?**	
5 min.	**STEP 2—** individualized Activity — Pre-Test	
	A. Present instructions for Pre-Test.	SM II- 2
	TURN TO PAGE U-l lN YOUR STUDENT MANUAL. YOU WILL FIND THE PRE-TEST FORM. TO COMPLETE THIS PRE-TEST, LISTEN AS I READ THE STATEMENTS PRINTED ON THE FORM.	
	AS YOU HEAR A STATEMENT, THINK ABOUT THAT STATEMENT AND THEN INDICATE WHETHER YOU AGREE OR DISAGREE WITH THE STATEMENT.	
	IF YOU AGREE, CIRCLE THE "A" (FOR AGREE) TO THE LEFT OF THE STATEMENT. IF YOU DISAGREE, CIRCLE THE "D" (FOR DISAGREE) TO THE LEFT OF THE STATEMENT.	
	B. Read the Pre-Test statements one time each.	
	Read each statement once, pausing after each statement briefly (1-2 seconds) so that students can record their response.	
	1. **A PLAN WILL GET ME READY FOR ANY HAZARDOUS MATERIAL EMERGENCY.**	

Decision Making in Emergencies
Slide/Tape Script

2001

Despite all the prevention efforts of the transportation and chemical Industrles, the release of hazardous materials isı possible.

2002

If and when that release occurs, the citizens in your community look to you as emergency response personnel for help.

2003

They expect you to act quickly to protect their lives and property. Needless to say, you must protect yourself in the process.

2004

Once you_ become- of a hazardous material problem, you are faced with a series of decisions that should focus on reducing the harm that would otherwise occur.

2005

The following steps will provide a guide for making these decisions. When involved in an emergency, you must

Detect hazardous material presence,
Estimate likely harm,
Choose response objectives,
Identify action options,
Do the best option, and
Evaluate process

2006

The acronym D.E.C.I.D.E. will help you remember these six steps.

2007

Let's look at these steps one by one

2008

The first step in any emergency IS to look for hazardous materials Numerous clues usually exist when hazardous materlals are present, but you must recognize them

2009 Once you detect the presence of hazardous materials. the next logical step is to determine the extent of the problem.

2010 In this step you need to predict the behavior of the hazardous material,

2011 predict the danger area, and then describe the potential harm to people, environment, and property within that danger area.

2012 Once you know what can be harmed, you have to decide what you will gain by getting involved.

2013 Therefore, you must decide what has already been lost, what is in danger but can be saved and what is not in danger, then determine your strategy.

2014 Next, consider the available action options or tactics which will help you accomplish your strategy

2015 Response options range from total involvement

2016 to immediate withdrawal, depending on the problem.

2017 choose the best course of action only after evaluating the advantages and disadvantages of each action option. You should choose the option with the greatest gain and the least loss.

2018 After choosing the best option, you must continuously observe the effect of your decision to ensure that the circumstances are flowing as anticipated. If not, you may have to go back through the steps in the decision process to see what is wrong.

2019

TO become "part of the solution, not part of the problem" in an emergency, you must follow

2020

a logical process similar to the D.E.C.I.D.E. Process. Your training and pre-emergency planning will help you make these decisions.

2021

Remember, your decisions will affect the outcome in the emergency.

If your decisions are wrong, you will find yourself making the outcome worse, instead of better. Since the initial decisions you make are so critical, the best advice is summed up in a single sentence:

2022

If you don't know,
Don't go
It might blow!

2023

Fortunately, many of these decisions can be made in advance I you know where hazardous materials are located in your community.

2024

Pre-emergency planning and inspections will make you familiar with potential hazardous material problems in your community.

2025

So where can we find hazardous materials? Just about everywhere!

2026

Manufacturing plants produce large quantities of hazardous materials.

2027

Hazardous materials, in the form of raw materials as well as finished products, are often stored at production sites.

2028

Hazardous materials are transported throughout the country by highway, rail, air, water, and pipeline.

3011 Construction sites may use blasting agents or explosives, fuels, and gases.

3012 Remember, inspection and planning allows you to become familiar with hazardous material locatlons in your community

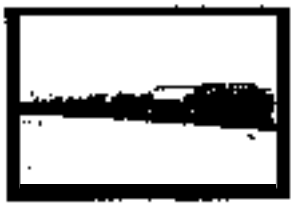
3013 *Next container shapes*

3014 The Department of Transportation regulates the packaging used to transport hazardous materials. Other natlonally recognized codes Include specifications for bulk storage containers.

3015 Packaging for hazardous materials can be broken down into three categories: Bulk storage; bulk transport vehicles; and small packages like drums, cylinders and fiberboard boxes.

3016 You should become familiar with the characteristics of the various containers then relate these characteristics to the contents during your pre-emergency planning and inspection activities.

3017 Stationary storage tanks come in a variety of sizes



3018 Rail tank cars can be pressurized or non-pressurized.

3019 For pressure cars, the fittings on the manway are totally enclosed. On non-pressure cars, the fittings are generally vislble.

3020 "Cryogenic" cars have no fittings on top. Loading and unloading IS done from the sides.

3108

The color of smoke and flame can help identify that hazardous material.

3109

Irrltatlon to the eyes or skin is also a signal that you are being exposed and that you should leave the danger area.

3110

To review, six categories of clues are used to detect hazardous materials'

- Occupancy and location;
- Container shapes,
- Markings and colors;
- Placards and Iabels;
- Shipping papers, and
- Senses.

Remember, ram, snow, and darkness reduce your ability to detect hazardous materials.

3111

You should develop your skills for detecting hazardous material presence through your pre-emergency plannlng, inspections, and training. Look for these clues as you approach any emergency scene.

3112

You can't handle a problem unless you realize the problem exists.

Hazardous Materials Definitions

The following definitions have been abstracted from the Code of Federal Regulations, Title 49-Transportation, Parts 100 to 199. Refer to the referenced sections for complete details. NOTE: Rulemaking proposals are outstanding or are contemplated concerning some of these definitions.

HAZARD CLASS	DEFINITIONS
	An Explosive - Any chemical compound, mixture, or device, the primary or common purpose of which IS to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device IS otherwise specifically classified in Parts 170-W. (Sec. 173.50)
CLASS A EXPLOSIVE	Detonating or otherwise of maximum hazard. The nine types of Class A explosives are defined in Sec. 173.53.
CLASS B EXPLOSIVE	In general, function by rapid combustion rather than detonation and include some explosive devices such as special fireworks, flash powders, etc. **Flammable hazard.** (Sec. 173.88)
CLASS C EXPLOSIVE	Certain types of manufactured articles containing class A or Class B explosives, or both, as components but in restricted quantities, and certain types of fireworks. **Minimum hazard.** (Sec. 173.100)
BLASTING AGENTS	A material designed for blasting which has been tested in accordance with Sec. 173.114a(b) and found to be so insensitive that there IS very little probability of accidental initiation to explosion or of transition from deflagration to detonation. (Sec. 173.114a(a))
COMBUSTIBLE LIQUID	Any liquids having a flash point above 100°F. and below 200°F. as determined by tests listed in Sec. 173.115(d). Exceptions to this are found in Sec. 173.115(b).
CORROSIVE MATERIAL	Any liquid or solid that causes visible destruction of human skin tissue or a liquid that has a severe corrosion rate on steel. (See Sec. 173.240(a) and (b) for details),
FLAMMABLE LIQUID	Any liquid having a flash point below 100°F. as determined by tests listed m Sec. 173.115(d). Exceptions are listed in Sec. 173.115(a).
	Pyroforic Liquid - Any liquid that ignites spontaneously in dry or moist air at or below 130°F. (Sec. 173.115(c))
	Compressed Gas - Any material or mixture having in the container an absolute pressure exceeding 40 psia at 70”F., or a pressure exceeding 104 psia at 130°F.; or any liquid flammable material having a vapor pressure exceeding 40 psia at 100°F. (Sec. 173.300(a))
FLAMMABLE GAS	Any compressed gas meeting the requirements for lower flammability limit, flammability limit range, flame projection, or flame propagation criteria as specified in Sec. 173.300(b).
NONFLAMMABLE GAS	Any compressed gas other than a flammable compressed gas.

SCOPE OF THE COURSE

Hazardous Materials Incident Analysis is designed to enable the student to better assess the hazardous materials emergency threat to people, property, and systems, through an analytical study of general hazardous materials emergency behaviors. The course is designed to develop the necessary skills to adequately define the problem posed by hazardous materials in emergency situations. These analytical skills will be reinforced throughout the course.

These skills can also be used to support your:

- Pre-emergency planning activities,
- Training of emergency response personnel,
- Learning from your own experience.

This course focuses on events analysis and defining the hazardous materials problem.

The course is best suited for the following personnel:

1. Fire officers
2. Fire training officers
3. Other emergency response agency supervisory and training personnel (EMS, law enforcement, emergency management, public health, etc.)

COURSE GOAL AND OBJECTIVES

The overall course goal is:

To provide the student with the knowledge to assess a hazardous materials emergency using the first two steps of the D.E.C.I.D.E, method.

Enabling objectives for students which lead to this goal are to:

- Define hazardous materials, and the Department of Transportation categories and classifications,
- Describe five areas hazardous materials are present in the community, and five modes of hazardous materials transportation.
- Describe three situations where hazardous materials created harm when released from their containers.
- Define a hazardous materials incident/emergency.
- Define "outcome" as it relates to an emergency.
- Name at least five potentially dangerous assumptions about hazardous materials.
- Specify ways hazardous materials emergencies are different.
- Give reasons why it is important to "define your hazardous material problem" before getting directly involved in an emergency.
- Explain course goals, objectives, scope, and limitations.
- Explain the purpose of an emergency response effort.
- List in order and describe Benner's D.E.C.I.D.E. steps.
- List and describe the six groups of clues for detecting the presence of hazardous materials.
- Recognize the presence of hazardous materials in scenarios from visual information about the scenarios.
- Describe the two parts of "estimating likely harm without intervention."
- Explain how events analysis can be used to estimate likely harm without intervention.
- Identify the significant events in a given scenario, and then place those events in sequence.
- Explain the format for describing likely outcomes in emergencies.
- Explain the process of identifying hazardous materials.
- Identify five specific sources of information to help identify hazardous materials.
- Prepare a "Hazardous Material Data Sheet."
- Describe the Hazardous Materials Behavior Model.
- List and be able to recognize the types of stress, breach, releases, dispersion, and hazardous materials travel patterns.
- Differentiate between impingement and harm, and identify factors which influence the range of harm.
- Identify four factors which affect behavior of hazardous materials in emergencies.
- Given three scenarios and background information, complete several events analysis worksheets.

Slide 24

Blasting agent is a material Intended to function by detonation, but is so Insensitive that there is very little probability of accidental explosion. Examples of blasting agents include ammonium nitrate-fuel oil mixtures and nitro carbonitrates.

Slide 25

Rail shipments and explosives are generally military ordnance and are often in wooden boxes shipped in box cars.

Slide 26

For commercial products, fiberboard boxes are used.

Slide 27

"Compressed gases" are materials In the container under a pressure exceeding 40 psia at 70°F or a pressure exceeding 104 psia at 130°F. For liquid flammable materials, the test for vapor pressure exceeding 40 psia is made at 100°F.

Slide 28

Compressed gases can be in a liquified or a nonliquified form.

Tank cars carry compressed gases in the liquid form. Gases are liquified by either pressure or extreme cooling-as in cryogenics.

Slide 29

Cylinders generally contain. nonliquified gases at high pressures.

Slide 30

Compressed gases may pose the danger of a violent rupture in an accident. Vapor can travel great distances. Vapors ignite. Vapors may be toxic and/or corrosive. Liquids released from compressed gas tanks may be very cold and could cause frostbite. Liquified gases can expand many hundreds of times beyond the size of their containers.

Slide 31

Flammable compressed gases can ignite and burn readily.

Slide 32

Nonflammable gases often are toxic and generally will not burn, but, like oxygen (a nonflammable gas), may support the combustion of other materials.

Slide 33

Common packages for compressed gases Include the:

Slide 82

A truck driver in MarshalIs Creek, Pennsylvania, noticed a tire fire on his vehicle, removed the placards, and then notified the fire department. Upon their arrival, firefighters could not find the driver or see any indication of the vehicle's contents. While attempting to extinguish the fire, the contents-thirteen tons of 1 blasting agent-exploded, killing SIX firefighters and destroying their apparatus.

Slide 83

A crossing accident in California injured four railroad personnel when the tram hit the rear of a double-bottom trailer containing methyl bromide, a poisonous liquid, which was released.

Slide 84

This incident involved a 1,900-gallon tank truck of LP gas that was ignited. The emergency personnel responding applied water to the tank for 45 minutes until their tanker operation was Interrupted causing them to pull back.

Slide 85

The tank never exploded. The action of the emergency response personnel in securing the area and pulling back the emergency personnel was correct, as It would have averted a major catastrophe and loss of life had the tank exploded.

Slide 86

Not all hazardous materials emergency become major incidents. The leakage of liquified petroleum gas (a flammable gas) through a nipple connected to the unloading valve on this rail car at an unloading rack was considered minor

Slide 87

In a rail yard, a splash of sulphuric acid, a corrosive material, from a failed rupture disk on the safety vent of this tank car injured d railroad employee

Slide 88

Hazardous materials incidents can occur in the home too. The occupant of this apartment was laying kitchen the using a flammable mastic. The vapors of the mastic were ignited by a cigarette, causing the entire apartment to burst into flames.

Slide 89

As we previously mentioned, hazardous materials play a vital part in the lives of nearly all Amencans. Few of us can go through a day wlthout coming into contact in some way; with these materials.

Slide 90

Manufacturing plants throughout the country produce large quantities of hazardous materials

TIME	CONTENT/METHODOLOGY	MATERIALS
25 min.	STEP 3-Individualized Activity- Mission and Purpose	
	• *Discuss the mission of the students' organizations.*	
	Have the students turn to page 11-6 of the Student Manual. Read the first question to the students.	Student Manual p. 11-6
	What is the mission of your organization?	Slide 156
	Let the students answer by writing their thoughts in the space provided on the questionnaire. Discuss the answer and try to form a consensus, If you can. Let some of the students read their answers. Try to bring out the following points from the students' answers:	
	• **Protect life and property.** • **Do the above safely.**	
	• *Discuss how the student's organizations accomplish that mission.*	
	Read Question 2 to the students.	
	How does your organization accomplish that mission?	Slide 157
	Let the students answer by writing their thoughts in the space provided on the questionnaire sheet. Discuss the answer and try to form a consensus, if you can. Let some of the students read their answers. Try to bring out the following points from the students' answers:	
	Prevention activities--- to stop emergency from happening.	
	Preparedness activities--- to get ready for the eventual emergency.	
	Response activities--- actual handling of the emergency.	
	Recovery activities--- getting your act back together after the emergency.	

Slide 155

Slide 156

Slide 157

TIME	CONTENT/METHODOLOGY	MATERIALS
25 min.	STEP 4 —_Interactive Lecture— Course Goals, Objectives, Scope, and Limitations • *Explain the reasons why studying hazardous materials is important for emergency response personnel.* • **They are first on the scene of emergencies.** • **Everyone expects them to handle emergencies during the first critical minutes.** • **Emergencies can happen in any community at any time.** • **Their regular training is not always suitable for hazardous material emergencies.** • *Comment briefly on the goals of the course.* **How do you know you are going to make a difference before you act in a hazardous material emergency?** As stated in the beginning, the **purpose of this course** is to teach you how to predict what is likely to happen with hazardous materials, before you act. **A problem properly defined is half solved.** Emphasize that this is an EMERGENCY ANALYSIS course, teaching problem definition for emergencies involving hazardous materials. This course emphasizes how to analyze the emergency to *define the emergency* problem-not how to solve the problem. That is taught in another course. An analytical method that will help you define the problem is called "Events Analysis." Using events analysis, we will emphasize two key skill areas in this course. 1. Detecting hazardous material in emergencies. Before we react to a hazardous material emergency, we have to first know they are present in the emergency. 2. *Estimating* the likely harm that will occur if we do nothing. You have to know what the problem is before you decide what you are going to do about it. This Course will deal with five Important questions. These questions are:	Sample Introductory Comments IC II-11

TIME	CONTENT/METHODOLOGY	MATERIALS
30 min.	STEP Z-Lecture with Slides- Present the D.E.C.I.D.E. Process	
	l *Introduce and List* the *D.E.C.I.D.E. Steps.*	
	Decisionmaking for emergencies involving hazardous materials calls for emergency response personnel to:	Slide 168
	Detect hazardous material presence.	
	Estimate likely harm without intervention.	
	choose response objectives.	
	Identify action options.	
	Do the best option.	
	Evaluate progress.	
	Make note of the acronym, D.E.C.I.D.E.	
	l *Discuss the D.E.C.I.D.E. Steps in* Detail.	
	• **Detect hazardous material presence.**	Slide 169
	• Critical in any emergency!	
	• If you are not aware that a hazardous material is present, how can you respond positively' to that emergency?	
	• Various clues are available to assist you in detecting the presence of hazardous materials (we will discuss them in the next unit).	
	• **Estimate likely harm without intervention.**	Slide 170
	• A difficult but indispensible step.	
	• If you don't know what is likely to happen, how can you figure out what it is you need to do?	

Slide 168

Slide 169

Slide 170

Slide 188

Local health departments often have poisons and flammable materials on the shelves.

Slide 189

High school chemistry labs have a wide range of hazardous materials.

Slide 19-O

Construction sites may use blasting agents or explosives,

Slide 191

This is why pre-emergency planning is important. Emergency response personnel should know their community-including the transportation facilities that serve it-well enough to know where hazardous materials are likely to be found.

Slide 192

Secondly, you can use Container shapes.

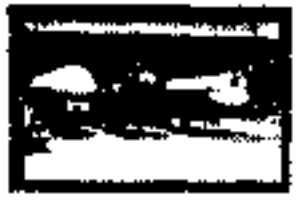
Slide 193

The Department of Transportation regulates the packaging used in the transportation of hazardous materials. Other nationally recognized codes include safety standards for bulk storage container.

Slide 194

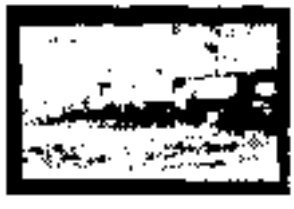
Packaging for hazardous materials can be divided into three categories: bulk storage containers; bulk transport vehicles; and small packages such as drums, cartons, and cylinders.

Slide 195



By noting container shapes and relating that shape to known contents in planning and inspection activities. emergency response personnel can have another clue to the presence of hazardous materials.

Slide 196



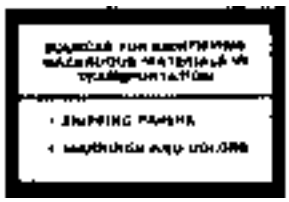
Stationary storage tanks in a variety of sizes and shapes are found throughout the community.

Slide 197

Rail tank cars can be pressurized or non-pressurized. For pressurized tank cars, the fittings on the manway are totally enclosed. On nonpressurized tank cars, the fittings and emergency relief devices are visible.

TIME	CONTENT/METHODOLOGY	MATERIALS
	• **Sources for identifying hazardous materials in transportation.**	**Slide 316**
	• **Shipping papers.**	
	• Proper shipping name of material; Identification number.	
	• Caution students about Not Otherwise Specified (NOS) shipments; Standard Transportation Commodity Code number by rail can identify specific material in N.O.S. category.	
	• **Markings and colors.**	
	• Identification numbers.	
	• Distance proximity to read numerals (less than 300 feet without binoculars).	
	• Only for tank car, tank truck, and portable tank shipments.	
	• **Sources for identifying hazardous materials in fixed facilities.**	**Slide 317**
	• **Markings and Colors** (names stenciled on contamers).	
	• **Pre-Emergency Planning** (Identify the materials handled).	
	In any case, write down the information. Do not rely on your memory.	
	Spell the name of the material correctly. Note the difference between ethanol and ethanal.	**Slide 318**
	• **Ethanol-Clear,** colorless liquid. Aromatic odor. Flash point of 59°F.	

Slide 316



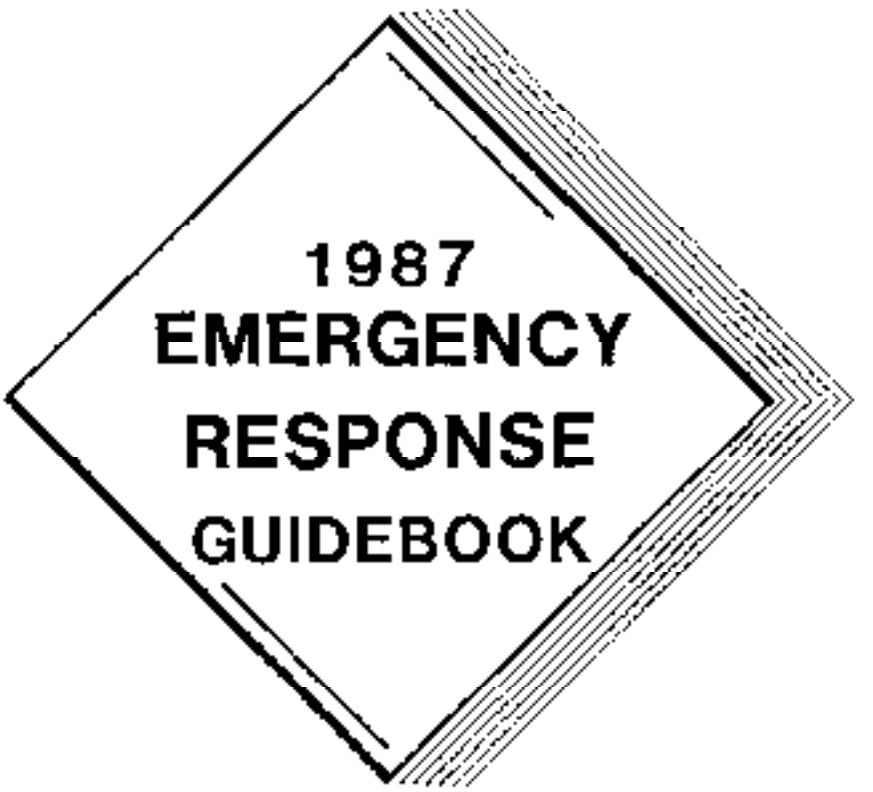
Slide 317

Slide 318

Appendix K

Excerpts from 1987 DOT Emergency Response Guidebook

DOT P 5800.4



GUIDEBOOK

FOR

INITIAL RESPONSE TO

HAZARDOUS MATERIALS INCIDENTS

READ INSTRUCTIONS
ON FIRST PAGE

Name of Material	Guide No.	ID No.
AMMONIUM BISULFITE, soln.	60	2693
AMMONIUM BIFLUORIDE SOLUTION	60	[illegible]
AMMONIUM CARBAMATE	31	9083
AMMONIUM CARBONATE	31	9084
AMMONIUM CHLORIDE	31	9085
AMMONIUM CHROMATE	31	9086
AMMONIUM CITRATE	31	9087
AMMONIUM DICHROMATE	35	1439
AMMONIUM DINITRO-o-CRESOLATE	42	1843
AMMONIUM FLUORIDE	54	2505
AMMONIUM FLUOBORATE	31	9088
AMMONIUM FLUOROSILICATE	53	2854
AMMONIUM HYDROGEN FLUORIDE, solid	60	1727
AMMONIUM HYDROGEN FLUORIDE SOLUTION	60	2817
AMMONIUM HYDROGEN SULFATE	60	2506
AMMONIUM HYDROSULFIDE SOLUTION	28	2683
AMMONIUM HYDROXIDE	60	2672
AMMONIUM METAVANADATE	53	2859
AMMONIUM NITRATE, liquid (hot concentrated solution)	35	2426
AMMONIUM NITRATE, with not more than 0.2% of combustible material	43	1942
AMMONIUM NITRATE, with organic coating	43	1942
AMMONIUM NITRATE FERTILIZER	43	2067
AMMONIUM NITRATE FERTILIZER, n.o.s.	43	2072
AMMONIUM NITRATE FERTILIZER [illegible] AMMONIUM NITRATE	[illegible]	[illegible]
AMMONIUM NITRATE FERTILIZER, which is more liable to explode than AMMONIUM NITRATE	46	0223
AMMONIUM NITRATE FERTILIZER, with [illegible]	43	[illegible]
AMMONIUM NITRATE FERTILIZER, [illegible] of combustible material	35	[illegible]
AMMONIUM NITRATE FERTILIZER, with AMMONIUM SULFATE	43	2069
AMMONIUM NITRATE FERTILIZER, with calcium carbonate	43	2068
AMMONIUM NITRATE [illegible] PHOSPHATE or POTASH	43	2070
AMMONIUM NITRATE - FUEL OIL MIXTURES	46	—
AMMONIUM NITRATE SOLUTION, [illegible] water	35	2426
AMMONIUM NITRATE-SULFATE MIXTURE	43	2069
AMMONIUM OXALATE	53	2449
AMMONIUM PERCHLORATE, average particle size of less than [illegible]	45	0402
AMMONIUM PERCHLORATE	43	1442
AMMONIUM PERMANGANATE	43	9190
AMMONIUM PERSULFATE	35	1444
AMMONIUM PICRATE, dry or wetted with less than 10% water	46	0004
AMMONIUM PICRATE, wetted with not less than 10% water	31	1310
AMMONIUM POLYSULFIDE SOLUTION	60	2818
AMMONIUM [illegible]	53	2854
AMMONIUM [illegible]	53	[illegible]
AMMONIUM SULFAMATE	31	9089
AMMONIUM SULFIDE SOLUTION	28	2683
AMMONIUM SULFITE	31	9090
AMMONIUM TARTRATE	31	9091
AMMONIUM THIOCYANATE	31	9092
AMMONIUM THIOSULFATE	31	9093
AMMUNITION, tear-producing, non-explosive	54	2017
AMMUNITION, [illegible]	15	[illegible]
AMYL ACETATE	26	1104
AMYL ACID PHOSPHATE	30	2819
AMYL ALCOHOL	27	1105
AMYL ALDEHYDE	26	2058
AMYLAMINE	68	1106
AMYL BUTYRATE	27	2620
AMYL CHLORIDE	29	1107
AMYLENE	26	1108
AMYL FORMATE	26	1109
tert-AMYL HYDROPEROXIDE, [illegible]	51	[illegible]
AMYL MERCAPTAN	27	1111
AMYL METHYL KETONE	26	1110

SEE HOW TO USE THIS GUIDEBOOK ON THE FIRST PAGE, IF YOU HAVE NOT YET BECOME FAMILIAR WITH THE DETAILS OF USING THESE INDEXES TO GUIDE PAGES.

* Look for the [illegible] next to this NAME in the TABLE [illegible] the back of this book. Use this in addition to the Guide [illegible]

POTENTIAL HAZARDS

is.
o skin and eyes.
or poisonous gases.
dilution water may cause pollutlon.

le materials (wood, paper. oil. etc)
violent.

EMERGENCY ACTION

away: isolate hazard area and deny entry.
apparatus (SCBA) and structural firefighter- S protective
ted protection
00-424-9300 FOR EMERGENCY ASSISTANCE. If Water
he appropriate authorltles.

CO_2. Halon or water spray
or fog.
rea if you can do It wlthout risk
xposed to flames with water from the side until well after
m ends of tanks.
rea, use unmanned hose holder or monitor nozzles.

ial.
paper, oil, etc.) away from splited material.
an shovel place material into clean. dry container and
rom spill area
d of liquid spill for later disposal

all emergency medical care
inaed clothing and shoes at the site
erial, immediately flush skin or eyes with running water

POTENTIAL HAZARDS

FIRE OR EXPLOSION

May ignite other combustible materials (wood, paper, 011. etc).
Mixture with fuels may explode.
Container may explode In heat of fire.
May explode from heat or contamination.
Runoff to sewer may create fire or explosion hazard.

HEALTH HAZARDS

Contact may cause burns to skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away: Isolate hazard area and deny entry.
Stay upwind: keep out of low areas.
Self contalned breathing apparatus and chemical protective clothing which is specifically recommended by the shipper or producer may be worn but they do not provide thermal protection unless it is stated by the clothing manufacturer. Structural flreflghter's protective clothing is not effectlve with these materials.
Fully encapsulated protective clothing should be worn for spills and leaks with no fire.
CALL CHEMTREC AT I-800-424-9300 FOR EMERGENCY ASSISTANCE. If water pollution occurs, notify the approprtate authorities.

FIRE

Small Fires: Dry chemical, COZ, Halon, water spray or standard foam.
Large Fires: Water spray, fog or standard foam is recommended.
Do not move cargo or vehicle if cargo has been exposed to heat.
Coot containers that are exposed to flames with water from the side until welt after fire IS out. Stay away from ends of tanks.
For massive fire in cargo area, use unmanned hose holder or monitor nozzles If this IS Impossible, wlthdraw from area and let fire burn

SPILL OR LEAK

Keep combustibles (wood, paper. oil. etc) away from spilled material
Do not touch spilled material: stop) leak If you can do It without risk.
Use water spray to reduce vapors.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal
Large Spills: Dike liquid spill for later disposal

FIRST AID

Move victim to fresh air, call emergency medical care
Remove and isolate contaminated clothing and shoes at the site
In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes

GUIDE 46

POTENTIAL HAZARDS

FIRE OR EXPLOSION

May explode and throw fragments l/3 mile or more if fire reaches cargo area

HEALTH HAZARDS

Fire may produce irritating or poisonous gases

EMERGENCY ACTION

In case of fire stop all traffic and begin to clear the area for 2500 feet (1/2 mile) 111 all directions.

Keep unnecessary people away.

Do **not** fight fire in cargo- Try to prevent a fire from reaching the explosive cargo compartment.

Self-contalned breathing apparatus (SCBA) and structural firefighter's protective clothing will provide limited protection

CALL CHEMTREC AT I-800-424-9300 AS SOON AS POSSIBLE, especially If there IS no local hazardous materials team available.

FIRE

Truck and Equipment Fires: Flood with water; if no water is available use Halon. dry chemical or dirt, CAUTION Tire fires may start agaln. Unhook and separate tractor from trailer if possible

Cargo Fires: Do **not** move cargo or vehicle if cargo has been exposed to heat. **Do not** fight fire when it reaches cargo. Withdraw from area and let fire burn.

Promptly isolate the scene by removing **all persons** from the vicinity of the incident if there is a fire. First, move people out of line-of-sight of the scene and away front windows. Obtain more information and specific guidance from competent au thorities who may be llsted on the shipping paper-s

If you know or suspect that heavily-encased Class A explosives. such as bombs or artillery projectiles, are being exposed to heat or flames. expand the Isolation area in all directions to 4000 feet (3/4 mile) for a Tractor/Trailer load. 5000 feet (1 mile) for a Railcar load.

SPILL OR LEAK

Shut off ignition sources: no flares, smoking or flames in hazard area

Do not touch spilled material.

FIRST AID

Call emergency medlcal care

Use first aid treatment according to the nature of the injury.

POTENTIAL

FIRE OR EXPLOSION

May Ignite other combustible material

Mixture with fuels may explode

Flammable/poisonous gases may

Container may explode in heat of fire

May explode from friction heat or cold

Runoff to sewer may create fire or ext

HEALTH HAZARDS

If Inhaled. may be harmful

Contact causes severe burns to skin a

Fire may produce irritating or poisonous

Runoff from fire control or dilution way

EMERGENCY

Keep unnecessary people away: isolat

Stay upwind: keep out of low area.

Self-contalned breathing apparatus clothing will provide limited protective

CALL CHEMTREC AT I-800-424-9300

pollution occurs. notify the appropriate

FIRE

Small Fires: Water only: no dry them

Large Fires: Flood fire area with water

Do not move cargo or vehicle of cargo

Cool containers that are exposed to fl fire IS out Stay away from ends of

For massive fire 111 cargo area use of this IS Impossible. withdraw from are

SPILL OR LEAK

Keep combustibles (wood. paper. oil c

Do not touch spilled materlal. stop leaf

Use water spray to reduce vapors

Small Spills: Flush area with floodlng

Large Spills: Dike liquid spill for later

FIRST AID

Move victim to fresh air and call emerc tlflclal respiration. If breathing IS different

Remove and isolate contaminated cloth

In case of contact with material net for at least 15 nilnutes

Keep victim quiet and maintain normal

ID No.	Guide No.	Name of Material
1914	27	BUTYL PROPIONATES
1915	26	CYCLOHEXANONE
1916	57	DICHLOROETHYL ETHER
1917	26	ETHYL ACRYLATE, inhibited
1918	26	CUMENE
1918	26	ISOPROPYLBENZENE
1919	26	METHYL ACRYLATE, inhibited
1920	27	NONANE
1921	30	PROPYLENEIMINE, inhibited
1922	26	PYRROLIDINE
1923	37	CALCIUM DITHIONITE
1923	33	CALCIUM HYDROSULFITE
1924	40	ETHYL ALUMINUM DICHLORIDE
1925	40	ETHYL ALUMINUM SESQUICHLORIDE
1926	40	METHYL ALUMINUM SESQUIBROMIDE
1927	40	METHYL ALUMINUM SESQUICHLORIDE
1928	37	METHYL MAGNESIUM BROMIDE in ethyl ether
1929	32	POTASSIUM DITHIONITE
1929	32	POTASSIUM HYDROSULFITE
1930	40	TRIBUTYL ALUMINUM
1930	40	TRIISOBUTYL ALUMINUM
1931	32	ZINC DITHIONITE
1931	32	ZINC HYDROSULFITE
1932	32	ZIRCONIUM, scrap
1935	55	CYANIDE SOLUTION, n.o.s.
1938	60	BROMOACETIC ACID, [illegible]
1938	60	BROMOACETIC ACID SOLUTION
1939	39	PHOSPHORUS OXYBROMIDE, solid
1940	60	THIOGLYCOLIC ACID
1941	28	DIBROMODIFLUOROMETHANE
1942	41	AMMONIUM NITRATE, with not more than 0.2% of combustible material
1942	41	AMMONIUM NITRATE with organic coating
1944	32	MATCHES, safety
1945	32	MATCHES, wax (Vesta)
1950	12	AEROSOLS
1951	21	ARGON, refrigerated liquid (cryogenic liquid)
1952	12	CARBON DIOXIDE-ETHYLENE OXIDE MIXTURE, with not more than 6% ETHYLENE OXIDE
1952	12	ETHYLENE OXIDE-CARBON DIOXIDE MIXTURE, with not more than 6% ETHYLENE OXIDE
1953	18	COMPRESSED GAS, flammable and poisonous, n.o.s.
1953	18	POISONOUS LIQUID or GAS, flammable, n.o.s.
1954	22	COMPRESSED GAS, flammable, n.o.s.
1954	22	DISPERSANT GAS, flammable, n.o.s.
1954	22	FLAMMABLE GAS, n.o.s.
1954	22	REFRIGERANT GAS, flammable, n.o.s.
1954	22	REFRIGERATING MACHINE, containing flammable, nonpoisonous, nonliquefied gas
1955	15	CHLOROPICRIN and NON-FLAMMABLE GAS MIXTURE
1955	15	COMPRESSED GAS, poisonous, n.o.s.
1955	15	METHYL BROMIDE and NON-FLAMMABLE COMPRESSED GAS MIXTURE
1955	15	ORGANIC PHOSPHORUS COMPOUND, mixed with COMPRESSED GAS
1955	15	PERCHLORYL FLUORIDE
1955	15	PHOSPHORUS TRIFLUORIDE
1955	15	POISONOUS LIQUID or GAS, n.o.s.
1955	15	TETRAFLUOROHYDRAZINE
1956	12	ACCUMULATORS, pressurized
1956	12	COMPRESSED GAS, n.o.s.
1956	12	HEXAFLUOROPROPYLENE oxide
1956	12	NONFLAMMABLE GAS, n.o.s.
1957	22	DEUTERIUM
1958	12	DICHLOROTETRAFLUOROETHANE
1959	22	[illegible]
1959	22	[illegible]
1960	22	[illegible]
1960	22	ENGINE STARTING FLUID
1961	22	ETHANE, liquid (cryogenic liquid)
1961	22	ETHANE-PROPANE MIXTURE, liquid (cryogenic liquid)
1962	22	ETHYLENE, compressed
1963	21	HELIUM, refrigerated liquid (cryogenic liquid)
1964	22	HYDROCARBON GAS, compressed, n.o.s.
1965	22	HYDROCARBON GAS, liquefied, n.o.s.

ID No.	G No.
1966	[illegible]
1966	[illegible]
1967	[illegible]
1967	[illegible]
1968	[illegible]
1969	[illegible]
1969	[illegible]
1970	[illegible]
1970	17
1971	17
1971	17
1971	22
1972	22
1972	22
1972	22
1972	22
[illegible]	12
[illegible]	12
1974	12

This is the ID No. INDEX for locating a GUIDE No. for the 4-digit ID No. found elsewhere on a panel, placard, shipping paper or package of hazardous material.

[illegible] HOW TO USE THIS GUIDEBOOK ON THE FIRST P[illegible] [illegible]COME FAMILIAR WITH THE DETAILS OF USING TH[illegible]

The UN Class (or Division) number may be displayed at the bottom of a placard or label, or on a shipping paper after the listed shipping name(s).

ITIONS CLASSIFICATION SYSTEM

)n numbers may be displayed at the bottom of placards description on shipplng papers. In certain cases, this replace the written name of the hazard class in the ship- rss and Division numbers have the following meanings:

sives
plosives with a mass explosion hazard
plosives with a projection hazard
plosives with predominantly a fire hazard
plosrves with no significant blast hazard
ry insensttive explosives

lmmable gases
nflammable gases
lson gases
rroslve gases (Canadian)

lable liquids
shpoint below -18°C **(0°F)**
shpoint -18°C and above but less than 23'C (73'F)
'jhpoint of 23'C and up lo 61°C (141°F)

able solids; Spontaneously combuslible materials; lterials that are dangerous when wet
nmable solids
tntaneously combustible materials
erials that **are** dangerous when wet

rs and Organic peroxides
lizers
nic peroxIdes

us and Etiologic (infectious) materials
onous materials
ogic (infections) materials

Ive materials

es

ID Guide No.	No.	Name of Material
0004	**46**	AMMONIUM PICRATE, dry or wetted with less than 10% water
0222	**46**	AMMONIUM NITRATE FERTI LIZER. with not more likely 2% of combustible material
0223	**46**	AMMONIUM NITRATE FERTI-LIZER, which is more likely to explode than UN0222
0357	**46**	SUBSTANCES EXPLOSIVE
0358	**46**	SUBSTANCES, EXPLOSIVE
0359	**46**	SUBSTANCES, EXPLOSIVE
0402	**46**	AMMONIUM PERCHLORATE. average particle size of less than 45 microns
1001	**17**	ACETYLENE
1001	**17**	ACETYLENE, dissolved
1007	**12**	AIR. compressed
1003	**23**	AIR. refrigerated liquid (cryogenic liquid)
1005	**15**	**AMMONIA***
1005	**15**	**AMMONIA, ANHYDROUS, liquefied***
1005	**15**	**ANHYDROUS AMMONIA**
1006	**12**	ARGON, compressed
1008	**15**	**BORON TRIFLUORIDE***
1009	**12**	BROMOTREIFLUOROMETHANE
1010	**17**	BUTADIENE, inhibited
1011	**22**	BUTANE or BUTANE MIXTURE
1012	**22**	BUTENE
1012	**22**	BUTYLENE
1013	**21**	CARBON DIOXIDE
1014	**14**	CARBON DIOXIDE-OXYGEN MIXTURE
015	**12**	CARBON DIOXIDE-NITROUS OXIDE MIXTURE
016	**18**	CARBON MONOXIDE
1017	**20**	**CHLORINE***
1018	**12**	CHLORODIFLUOROMETHANE
1020	**12**	CHLOROPENTAFLUORO-ETHANE
1021	**12**	CHLOROTETRAFLUORO-ETHANE
1022	**12**	CHLOROTRIFLUOROMETHANE
1022	**12**	TRIFLUOROCHLORO-METHANE
1023	**18**	COAL GAS
1026	**18**	CYANOGEN
1026	**18**	**CYANOGEN, liqueified***
1027	**22**	CYCLOPROPANE
1027	**22**	CYCLOPROPANE, liquefied
1028	**12**	DKHLORODIFLUOROMETHANE
1029	**12**	DICHLOROFLUOROMETHANE
1029	**12**	DICHLOROMONOFLUORO-METHANE
1030	**22**	DIFLUOROETHANE
1032	**19**	**DIMETHYLAMINE, anhydrous ***
1033	**22**	DIMETHYL ETHER
1035	**22**	ETHANE compressed
1036	**68**	ETHYLAMINE
1036	**68**	MONOETHYLAMINE
1031	**27**	ETHYL CHLORIDE
1038	**22**	ETHYLENE, cryogenic liquid
1038	**22**	ETHYLENE, liquid (refrigerated)
1039	**26**	ETHYL METHYL EITHER
1039	**26**	METHYI. ETHYL EITHER

look for information next to this **NAME** In the TABLE OF EVACUATION DISTANCES in the back of this book, Use this in addition to the Guide Page If there Is NO FIRE

Appendix L

Material Safety Data Sheet on
Ammonium Nitrate/Fuel Oil Mixture

MATERIAL SAFETY DATA SHEET MSDS#1002

5/02/88

SECTION I - PRODUCT IDENTIFICATION

Trade Name: ALANFO Series Chemical Name: Mixture

Synonyms: ANFO, IREMIX, IREMIX 180, 183, 186, 187, 188, 189, 190

product Appearance & Odor: Oily, cream colored prill with fuel oil odor,

DOT Hazard Class: Blasting Agent

SECTION II - HAZARDOUS INGREDLENTS

Ingredients:	Cas#	%	TLV

Ingredients as used in this product are not hazardous as defined under current Department of Labor Regulations.

SECTION III - PHYSICAL DATA

Boiling Point: NA Vapor Pressure: -1.5,mm Hg @ 75°

Vapor Density: >I Specific Gravity: .83 to ,95

Percent Volatile by Volume: 6%

Evaporation Rate (Butyl Acetate - 1) <I Solubility in Water Appreciable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: NA Flammable Limits: NA Lel UEL

Extinguishing Media:

>100°

Special Fire Fighting Procedures:

Fires involving explosive materials should not be fought.
Evacuate personnel to a safe location up wind of the fire.
Burning material may produce toxic vapors.

Unusual Fire and Explosion Hazards:

Can explode under fire conditions.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes

May cause irritation, redness and tearing.

Skin

Prolonged contact may cause irritation.

Ingestion

Large amounts may be harmful if swallowed.

Inhalation

May cause dizziness, nausea, intestinal upset.

Systemic or other effects

Undetermined,

Emergency and First Aid Procedures

Eyes

Irrigate with running water for at least 15 minutes.
If irritation persists, seek medical attention.

Skin

Wash with soap and water.

Ingestion

Induce vomiting, seek medical attention.

Inhalation

Remove to fresh air.

Special Considerations

None.

SECTION VI - REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Keep away from heat, or open flame.

Materials to Avoid (Incompatibility):

Strong alkali or strong acid.

Hazardous Decomposition Products:

CO, NO_x

Hazardous Polymerization May not occur.

Conditions to Avoid:

N/A

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled:
Protect from heat, sparks and open flame.

'Waste Disposal Method:
Dispose of in accordance with Federal, State and local regulations.
Consult manufacturer for best disposal method.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation:
General room ventilation is normally adequate.

Respiratory Protection
None normally required.

Protective Clothing:
Gloves and work clothing which reduce skin contact are suggested,

'Eye Protection:
Safety glasses are suggested.

Other Precautions Required:
None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling & storage:

Store in compliance with all local, State and Federal regulations.

Other Precautions:

Explosive material. Keep away from heat, sparks and open flame.

Disclaimer
The statements contained herein are offered for information purposes only and are intended only for persons having related technical skills. Because conditions and manner of use are outside our control, it is the user's responsibility to determine the conditions of safe use of the product.

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Appendix M

Hazardous Material SOP for Kansas City, Missouri, at Time of Explosion

Subject: Handling Hazardous Materials	Effective Date 3/1/81	M.I. No. 5-2
Applies to: All Fire Fighting Personnel	Supersedes	Page1 of 12

This is the Standard Operating Procedures for the Kansas City, Missouri Fire Department for the handling of hazardous materials. The SOP will go into effect this date and will only be superceded by further orders from the Fire Chief and Administrative Deputy Chief.

It is mandatory that ALL PERSONNEL follow this SOP to protect themselves, fellow fire fighters and civilians.

1. PURPOSE

The purpose of this manual is to provide a uniform guideline to assist personnel engaged in responding to a Hazardous Materials Incident.

To a large extent, it is based on current procedures and is designed to cover the conditions prior to and after the incident.

This manual can be used to train all existing personnel and any future personnel.

Some mandatory statements are included in this manual and are identified with the words "will" and "shall".

All comments and suggested revisions should be made to the Fire Department Fire Chief/Director and/or Administrative Deputy Chief.

2. SCOPE AND APPLICABILITY

The guidance provided here focuses on the contingency plan and the Fire Departments responsibility in the command and control of an incident involving Hazardous Materials. Especially, the guidance outlines department policy, assigns responsibilities to fire personnel, and identified areas and equipment to be used in a Hazardous Material incident. This document is not intended to be used as a stead fast rule, but as a guideline of procedure.

The procedures and guidelines within this manual apply to all the Fire Personnel.

Any and all other technical personnel and documents should be used.

3. MISSION

The primary mission of the Fire Department is to protect the life, health and safety of all the citizens within the K.C. City Limits and to provide any assistance to other areas as is deemed necessary.

This is accomplished through the implementation of procedures to handle unplanned and/or unauthorized incidents involving the release or potential release of any harmful or potentially harmful substance.

4. POLICY

The Fire Department Policy pertaining to the implementation of the cities contingency plan shall be:

A. To receive all calls pertaining to Hazardous Materials.

B. Respond to the incident scene.

C. Evaluate the situation.

D. Engage in measures to bring incident under control.

E. Use the assistance of other agencies.

F. To train and equip all personnel of the Fire Department to insure a safe professional and efficient operation during emergencies.

5. NOTIFICATION

Upon receiving a call concerning a Hazardous Material incident, the dispatcher will obtain answers to as many questions on FD 100 as is possible.

He/she will dispatch the proper amount of equipment and manpower to initially handle the incident, such as: 1 Chief, 2 pumpers, and 1 truck.

He/she will convey by radio, as the companies are enroute, such information as amount and type of material involved, type and size of container, wind direction and speed, if on fire or if a spill, if injury is involved, whether police are on scene.

He/she will alert the Deputy Chief and the Training School of the situation.

6. EVALUATION AND INITIATION OF ACTION

1. When the first officer (Captain or Chief) arrive they will:

   A. Evaluate the situation.

   B. Put on full protective gear and see that all others are suited up. Including:
      1. Mask
      2. Boots
      3. Coat
      4. Helmet
      5. Gloves

   C. Initiate the "First Steps to take in a Hazardous Materials Incident". This is anything pertaining to the type of material involved.

   D. Obtain as much information on material as possible such as:
      1. Placards - Labels
      2. Shipping papers
      3. Involvement
      4. Exposures
      5. Special equipment needed
      6. Advice needed
      7. Assistance needed
      a. Request command vehicle, if needed

   E. Advise other responding units of the situation and precautions to be taken.

   F. Notify dispatcher by radio of situation and action taken.

   G. If situation warrants it he will set up a command post.

   H. Advise the higher ranking officer of actions taken.

   I. Assist the incident commander by advising of progress being made and/or any changes in situation.

6. EVALUATION AND INITIATION OF ACTION

II. ON SITE ACTIVITIES

The incident commander being the highest ranking officer will do the following

A. Take charge of the incident command post.

B. Request any assistance from other agencies he deems necessary.

C. Request traffic control and evacuation of personnel from exposure area, from the P.D. and media.

D. Request any emergency medical needed. Request decontamination team, if needed.

E. Request the contingency plan be implemented, if situation warrants.

F. Set up a secondary command post in a safe area.

G. Set up a staging area for relief and decontamination purposes.

H. Request any other assistance needed.

I. Report by radio to the dispatcher and City Emergency Preparedness progress reports.

J. Provide Fire Personnel to assist in accountability of people evacuated.

K. Provide personnel and equipment until the situation has been cleared up.

L. Compile reports from all agencies:

1. These reports may be used for training and evaluation of operation.

7. EQUIPMENT ON COMMAND VEHICLE

TO BE ADDED LATER.

8. TYPES OF REPORTS

TO BE ADDED LATER.

9. LIST OF AGENCIES

AGENCIES	RESPONSIBILITIES
Police Department	Traffic Control and Evacuation
Chemtrec	Advise
Public Works	Dyking materials
Power and Light	Ignition Source Elimination
Gas Service Company	Ignition Source Elimination
Health Department	Monitoring
E.P.A. (State and Federal)	Monitoring
Shipper	Advise
Consignee	Advise
Media	Evacuation and Information
Emergency Preparedness	Contingency Plan
Emergency Medical	First Aid
Salvation Army	Care of Evacuated
Red Cross	Care of Evacuated
Local Contractors	Machinery

Appendix N

List of Slides/Photographs

NOTE: Photographs included with this report are Slide 12 (trailer) and aerial photograph H9 (view of site).

All other photos and slides are included with USFA official file copies.

List of Slides

The slides listed below were taken in the Kansas City area shortly after the incident by Jack Yates. All also are available as photographs.

Slide Number	Description
2	View of typical Type 5 mobile magazine as seen from the right front corner. It is enclosed in chain link fence with gates at both ends. This is a smaller, single axle trailer but a tandom axle would also fit in the enclosure.
12	Type 5 mobile magazine as seen from the right rear corner. Note the built up earthen berm to the left of the magazine in accordance with ATF regulations.
10	View of rear door of the magazine with placards down. The left placard is the only one that would apply to the contents shown -- blasting agents. The center placard is for class A explosives; this to be opened when this magazine is carrying this substance.
11	Latch mechanism and lock for the mobile magazine. The latch appears to be similar to the type commonly seen on freight trailers. The lock is a heavy-duty type.
3	View of a lock and disabling mechanism on the king pin of the trailer, preventing one from simply backing under it and towing it away.
7	Interior of Type 5 mobile magazine.Construction and makeup of the magazine is as that of a standard freight trailer with the exception of vents at the front and rear. Ammonium nitrate/fuel oil mixture sacks, 50 pounds in size, are stored inside this magazine.
5	Closer view of storage sacks. Maynes Mix 1 is the manufacturer's trade name. Other manufacturers will have their own name. The yellow diagonal in the lower left corner of the sack identifies this as a blasting agent.

16 View of a Type 2 magazine for high explosives. It is portable to the extent that it can be moved from site to site, but it is not on wheels and is of much heavier construction. Note earthen berms built around it.

15 Closer view of Type,2 magazine. Double locks for this magazine are protected under the steel hoods on the left side of the door.

13 Thick, double steel side wall construction of the Type 2 magazine is shown. High-level explosives are seen stored inside.

18 Type 4 magazines for low explosives are shown in this view. These magazines are smaller than the Type 2 previously shown, but are still of very heavy construction and are basically similar in material/ design makeup.

19 Side view of one of the Type 4 magazines. This shows a dark spot where someone fired a shot at the unit. The bullet did not penetrate the outer material.

20 The Type 2 and 4 magazines and properly distanced from one another. The Type 2 magazines are beyond the crest of the hill several hundred feet from these Type 4 magazines.

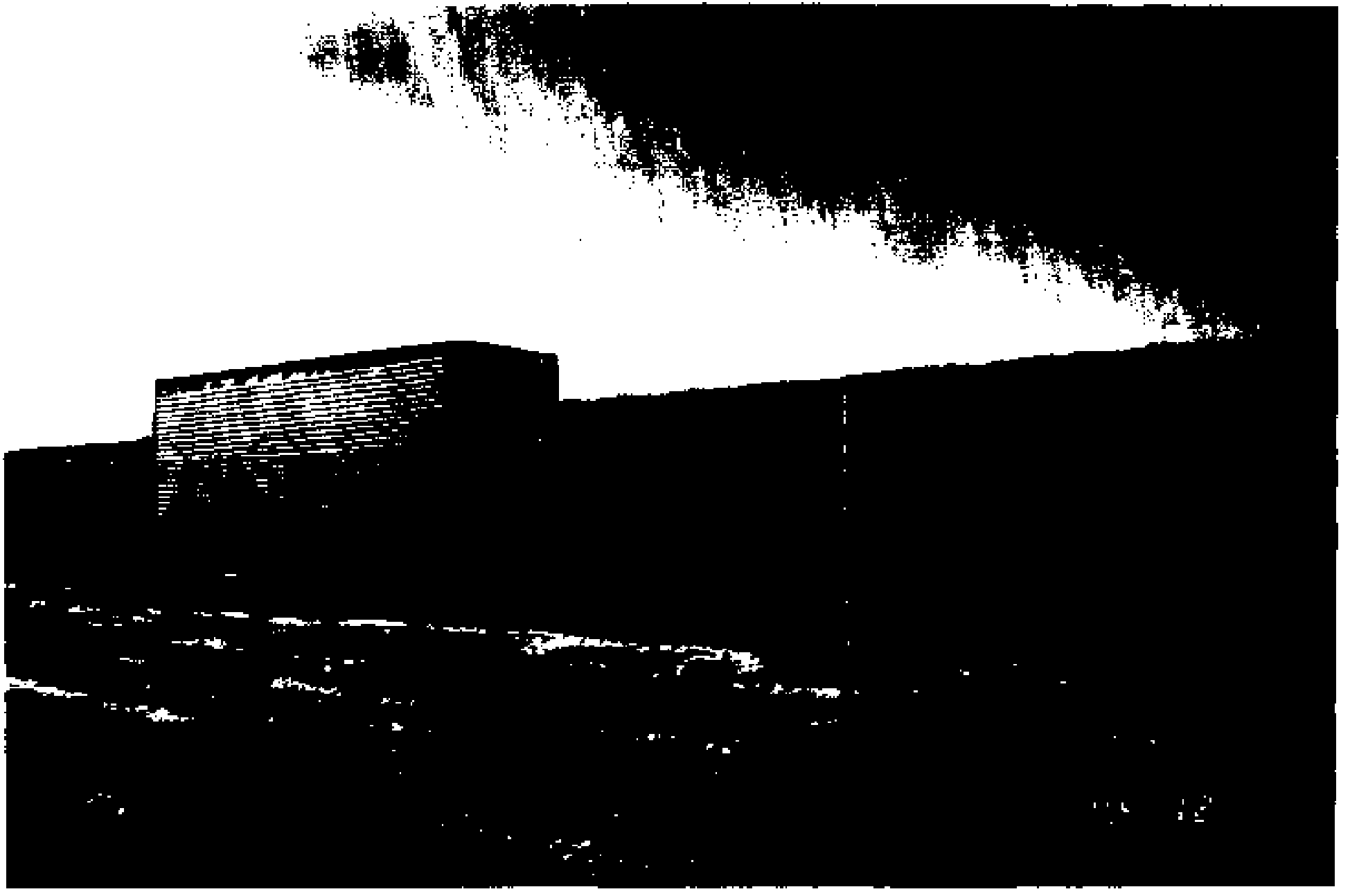
List of Aerial Photographs

The photographs listed below were provided by the Kansas City Fire Department.

Photograph	Description
H1*	View of fire after first explosion
H2*	View of site from helicopter after daybreak - from west to east
H3	View of site from helicopter after daybreak - from southwest to northeast
H4	View of site from helicopter after daybreak - from south/southwest to north/northeast
H5	View of site from helicopter after daybreak - from south to north
H6	View of site from helicopter after daybreak - from south to north
H7	View of site from helicopter after daybreak - from southeast to northwest
H8	View of site from helicopter after daybreak - from east/southeast to west/northwest
H9*	View of site from helicopter after daybreak - from east to west
HlO	View of site from helicopter after daybreak - from northeast to southwest
HII	View of site from helicopter after daybreak - from northeast to west/southwest
H12	View of site from helicopter after daybreak - from northeast to west - further north of explosion site

* - Photos made into slides

Best available image



Best available image