Firefighter Fatality Investigation

Abbott Volunteer Fire Department
Bruceville-Eddy Volunteer Fire Department
Dallas Fire-Rescue Department
Mertens Volunteer Fire Department
Navarro Mills Volunteer Fire Department
West Volunteer Fire Department

Investigation FFF FY 13-06

West, Texas
April 17, 2013

9641393

The subsequent investigation of this incident provides valuable information to the fire service by examining the lessons learned, to prevent future loss of life and property.

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Chief Steve Bass, City of Grapevine, Texas: Group Leader
Chief Jimmy Chew, City of Stephenville, Texas
Chief Brian Crawford, City of Plano, Texas
Chief Danny Kistner, City of McKinney, Texas
Chief Les Stephens, City of San Marcos, Texas

Technical advice provided by:
Martin T. Gresho, PE, FP2FIRE

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West Volunteer Fire Department
City of West Police Department
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McLennan County Sheriff's Office
McLennan County Office of Emergency Management
Texas Commission on Fire Protection
Texas A&M Engineering and Extension Service
East Texas Medical Center
National Institute for Occupational Safety and Health
And the many responders to the incident

Executive Summary

On April 17, 2013, the West Volunteer Fire Department responded to the report of a structure fire at the West Fertilizer Plant in the City of West, Texas. The fire department arrived to a heavily involved structure fire and mutual aid was requested. West Emergency Medical Services (EMS) responded along with students attending an Emergency Medical Technician-Basic (EMT) class at the West EMS building. The West EMS facility is located a few blocks west of the fertilizer plant. Students included members representing various area fire departments.

The fire involved the seed and fertilizer building known as the Bulk Processing Plant. Pallets with bags of seed and fertilizer were stored and sold from the north end of the building known as the seed room. The plant's bulk materials were stored in large wood lined bins with varying amounts of the multiple products used in the local farming community. These bulk products lined the west side of the building. A larger storage bin containing ammonium nitrate pellets was located in a central area of the north end. The bulk chemicals were mixed at the plant according to each customer's specifications and then distributed to customers from a loading dock and conveyor chute on the east side of the building. Chemicals included ammonium nitrate, potash, ammonium sulfate, diammonium sulfate, and KMAG – a mixture of potassium, magnesium, and sulfur. Storage tanks of liquid chemicals including liquefied anhydrous ammonia, a corrosive, flammable, and water reactive gas (stored under pressure as a liquid), were located near the south end of the structure.

The fire department response included an attack to the interior of the building by directing water streams through the east side rolling door from two 1½ inch hose lines. Responders called for an evacuation of the nursing home and park west of the plant and mutual aid was requested. As the building became more involved the roof collapsed and an explosion occurred. The blast killed ten firefighters, two civilians responding to assist, and three civilians in the residential area west of the plant. Several more responding firefighters suffered debilitating or near-fatal injuries. The blast created a 90-foot-wide and 10-foot-deep crater, and damaged or destroyed 500 structures in a 37-block area including three schools, the West EMS building, a nursing home, an apartment complex, and many single-family homes. Civilian injuries totaled more than 200. Initial loss estimates reached $100 million. Pieces of debris from the plant were photographed as far away as 2.5 miles. The explosion registered a 2.1 on the Richter scale for earthquakes. The subsequent investigation of this incident provides valuable information to the fire service by examining the lessons learned, to prevent future loss of life and property.

West Volunteer Fire Department (VFD) is a volunteer fire department and does not fall under the jurisdiction of the TCFP and is not required to abide by the rules and standards of the TCFP.

The final analysis of this incident does not suggest the firefighters who lost their lives, or any surviving members of the West VFD, failed to perform their duties as they had been trained, or as expected, by their organization.

This report is intended to honor the sacrifice made by these firefighters and all the first responders while protecting their community so that others may not perish.

Jerry Dane Chapman
Abbott Volunteer Fire Department

Cyrus Reed
Abbott Volunteer Fire Department

Kevin Sanders
Bruceville-Eddy Volunteer Fire Department

Captain Kenneth Harris
Dallas Fire-Rescue Department

Perry Calvin
Mertens Volunteer Fire Department and Navarro Mills Volunteer Fire Department

Morris Bridges
West Volunteer Fire Department

Cody Dragoo
West Volunteer Fire Department

Joseph Pustejovsky
West Volunteer Fire Department

Douglas Snokhous
West Volunteer Fire Department

Robert Snokhous
West Volunteer Fire Department

Two civilians on the fire scene died in the blast. Jimmy Matus, manager of a local fire apparatus manufacturing company, responded to the scene to assist the fire department with the operation of the fire truck. William Uptmor, Jr., responded to evacuate livestock at a property located east of the plant.

The Dallas County Medical Examiner's Office performed the autopsies and determined the deaths a result of blunt force and blast injuries.

Introduction

On April 17, 2013, the State Fire Marshal's Office (SFMO) received notification from the State Operations Center of multiple firefighter fatalities at a fire and explosion incident in the north-central Texas community of West. The fire at the West Fertilizer Plant was reported at approximately 7:29 p.m. The explosion occurred at approximately 7:51 p.m.

The State Fire Marshal's Office commenced the firefighter fatality investigation under the authority of Texas Government Code Section 417.0075.

If a firefighter dies in the line of duty or if the firefighter's death occurs in connection with an on-duty incident in this state, the state fire marshal shall investigate the circumstances surrounding the death of the firefighter, including any factors that may have contributed to the death of the firefighter.

In conducting an investigation under this section, the state fire marshal has the same powers as those granted to the state fire marshal under Section 417.007. The state fire marshal will coordinate the investigative efforts of local government officials and may enlist established fire service organizations and private entities to assist in the investigation.

The investigation began on April 17, 2013, with a response to the incident site for an initial assessment and survey. The SFMO team members responded to the incident location to assess the damages and determine the equipment and personnel numbers needed to investigate the incident. Several agencies had already responded to the site to assist the City of West, the McLennan County Office of Emergency Management, and the McLennan County Sheriff's Office with several tasks including: to locate and care for victims, control and extinguish fires, evacuate nearby residents, and mitigate continuing hazards. Subsequent activities over the next few days included the mitigation of hazards presented by the chemicals stored at the fertilizer plant, including anhydrous ammonia and the recovery of victims.

The State Fire Marshal's Office notified the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) and requested assistance from the ATF National Response Team (ATF-NRT) to assist in the investigation of the incident.

The State Fire Marshal's Office requested assistance from the Texas Fire Chiefs Association to provide personnel to review the operations and tactics utilized by the West Volunteer Fire Department and other agencies for the response to the fire. The fire chiefs of five Texas fire departments responded to assist in the evaluation of the response and tactics utilized: Chief Steve Bass,

City of Grapevine, Texas - Group Leader; Chief Jimmy Chew, City of Stephenville, Texas; Chief Brian Crawford, City of Plano, Texas; Chief Danny Kistner, City of McKinney, Texas; and Chief Les Stephens, City of San Marcos, Texas.

The Texas Department of Public Safety (DPS) and the Texas Parks and Wildlife Department (TPWD) provided scene security and assisted in the investigation. DPS is responsible for the Texas Department of Emergency Management, providing the Incident Management System support. The DPS Criminal Investigation Division conducted interviews and provided background information. The Texas Highway Patrol provided traffic control, scene security and initial emergency management.

The Texas Commission on Environmental Quality assisted in the mitigation of the remaining hazards and air monitoring of the site.

The National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program was notified. NIOSH responded with a team to conduct an independent investigation of the incident to determine contributing factors in the firefighter deaths. The goal of the NIOSH investigation is to provide information to the fire service nationally to prevent firefighter injuries and deaths.

The Texas Commission on Fire Protection (TCFP) assisted in the evaluation of the personal protective equipment used by the West VFD to determine if there were any contributing factors to the injuries sustained by the firefighters.

The SFMO and ATF were the lead investigating agencies and coordinated investigative efforts of the on-scene personnel.

The investigation of the incident involved more than 230 personnel representing over 30 local, state, and federal agencies. The initial investigation and site examination continued for 31 days after the fire and explosion. All agencies operated under a unified command structure as recommended in the National Incident Management System (NIMS). This allowed for the sharing of investigative responsibilities according to each agency's statutory authority.

Recommendations to prevent injuries and reduce risks for fire departments include:

- Develop standard operating procedures/guidelines to train and educate members on firefighting and emergency scene strategies and tactics for high-hazard occupancies.

- Develop pre-incident plans by visiting the commercial and high-risk properties within the response jurisdiction.

- Utilize risk management systems on all emergency responses to determine when to employ alternative tactics.

- Incorporate incident management systems into every emergency incident, training exercise and basic operational process of the fire department to provide appropriate command and control for conducting operations.

- Implement a strategic incident action plan (IAP) for all emergency operations through a coordinated application of appropriate emergency scene tactics for the presented dangers.

- Ensure that an incident safety officer (ISO), a person who is independent from the incident commander, is appointed and effectively utilized at every incident that would require an ISO.

- Establish a hazardous materials program and actively train members on the tactics to use when an incident involving hazardous materials occurs.

- Install approved fire protection systems in hazardous buildings in accordance with National Fire Protection Association (NFPA) Standards.

- Ammonium nitrate shall be separated by fire barrier walls of not less than 1-hour fire resistance or located in a separate building as required by ***NFPA 400, Hazardous Materials Code, 2013 Edition.***

- Local jurisdictions should adopt and enforce a fire prevention code. Codes prescribe minimum requirements necessary to establish a reasonable level of fire and life-safety and property protection from the hazards created by fire, explosion, and dangerous conditions.

- Existing structures that do not meet the requirements of ***NFPA 400, 2013 Edition,*** should be retroactively provided with several key features to assure adequate public and firefighter safety.

- Develop written policies and have procedures in place to restrict members from participating in department activities while under the influence of alcohol or drugs.

West Volunteer Fire Department

The City of West is located in north-central Texas in McLennan County, approximately 70 miles south of Dallas and 20 miles north of Waco. The city was established in 1892. The West Volunteer Fire Department was established in 1894 and was located at the city hall until 2003, when a new facility was built. The department serves an area of approximately 54 square miles. The 2010 census indicated that over 2800 people live in the city limits.

The department listed 31 members on the roster and uses a pager system for incident notification. There are sirens placed throughout the city for notification to the department members and the city residents. Apparatus included:

- (F6) White Brush Truck: 1991 Ford F700 with a 750-gallon tank, 200 feet of 1½ inch hose cross lay, two 1-inch whip lines, and a 1-inch booster reel

- (F7) Red Tender: 1997 GMC K5500 2000 gallon Tender with a 1-inch booster reel hose

- (F8) Engine 1: 1997 Spartan Quality with a 1500 g.p.m. Hale pump; 750-gallon tank; 1000 feet of 4-inch hose; three 200 feet, 1½ inch hose cross lays; and 150 feet of 1½ inch quick attack bumper line

- (F9) Engine 2: 2004 Ford F750 XL Super Duty with a 1500 g.p.m. Darley Pump; 1000 gallon tank; 1000 feet of 4-inch hose; two 200-feet, 1½ inch hose cross lays; and one 50-foot, 1¾ inch quick attack bumper hose

- (F10) Red Brush Truck: 2010 Ford F550 with a 150 g.p.m. pump, 400-gallon tank, 200 feet of 1½ inch hose, and a 1-inch booster line.

Three West VFD trucks were destroyed in the explosion. The West VFD was left with the 1997 Spartan Quality Engine 1 and the 2010 red brush truck. Several area departments volunteered time and equipment to work at the department to respond to calls as the department recovered.

During 2011, West VFD responded to 118 emergency calls including 55 fire calls. There were 3 structure fire incidents, 2 vehicle fires, and 50 "other fire" incidents including brush fires, grass fires, miscellaneous fires and false alarms.

During 2012, West VFD responded to 104 emergency incidents, of which 73 were fire related. The 73 fire-related incidents were 18 structure fires, 12 vehicle fires and 43 classified as "other fire" calls involving grass fires, miscellaneous fires, and false alarms.

During the first three months of 2013, West VFD responded to 2 structure fires, 1 auto fire, and 5 miscellaneous fire calls.

Applicants for membership in the West VFD must be 21 years old. Membership is dependent on a vote by the fire department members. The West VFD conducts two scheduled meetings per month that members must attend unless excused by the fire chief. One meeting is to conduct fire department business and the other meeting is for training. Members missing more than two training classes per year are required to present a valid excuse. New members accepted by the department must pass a background check before participating in any training. The fire department does not have any minimum training requirements.

The fire department received an upgraded rating from the Insurance Services Organization (ISO) [1], moving from a rating of 7 to a rating of 5. In the ISO rating system, Class 1 represents exemplary fire protection, and Class 10 indicates that the area's fire-suppression program does not meet ISO's minimum criteria.

The City of West's water system is supplied by a 12-inch supply line from the City of Waco at a pump station 11 miles south of the City of West. The pump station supplies 700 gallons per minute with a storage capacity of 167,000 gallons. Household water pressure was normally 48-50 PSI. Water pressure on the morning of April 18, 2013, was measured below 20 PSI because of damaged water lines. As a result, a water boil announcement was required. City main water lines are mostly 8-inch cast iron. Approximately 25 percent of the city main lines had been replaced with 8-inch PVC. The 8-inch water mains reduce to 6 inches at fire hydrants. Hydrants in the city have a steamer connection that requires an adaptor. Engine One and Engine Two each have 2 adaptors on board. Mutual aid responders arriving post blast, connected to the 2½ inch hose connections, as they were not equipped with a steamer connection adaptor.

Two wells supplying water in the city are out of service. Well 1, supplying 250,000 gallons in capacity, has been out of service for approximately 7 years. Well 2, which supplied 250,000 gallons, was taken out of service in January 2013 for "rehab." The above-ground water tower has a storage capacity of 150,000 gallons. Post-blast fire department response nearly drained the system, according to the Director of the City of West Water Department.

[1] ISO is an independent commercial enterprise which helps customers identify and mitigate risk. ISO can provide communities with information on fire protection, water systems, other critical infrastructure, building codes, and natural and man-made catastrophes. ISO's Public Protection Criteria program evaluates communities according to a uniform set of criteria known as the Fire Suppression Rating Schedule (FSRS). http://www.isogov.com/about/.

Building Structure and Systems

Neither the City of West nor McLennan County have adopted a fire code or building codes. There is not a designated fire marshal on staff in either jurisdiction who conducts fire safety inspections.

National Fire Protection Association (NFPA) Standard 101, Life Safety Code, 2012 Edition, is adopted by the State Fire Marshal's Office, and is the applicable standard for fire and life safety inspections in the absence of an adopted fire code within unincorporated areas of a county by an applicable authority. There was no requirement or request for the State Fire Marshal's Office to inspect this facility prior to this incident.

In preparing this report, the ***National Fire Protection Association* (*NFPA) 1, Fire Code, 2012 Edition,*** was referenced as a guide for evaluating the building's fire safety features. Similar provisions can be found in the ***International Fire Code*** as well.

History

The structure was originally built in 1962, with several subsequent additions, up to the 1980s. It was reported that at the time the facility was originally constructed it essentially existed alone in what was a rural farming area, and the neighborhood slowly evolved around the fertilizer facility over many years.

The fertilizer plant property is located alongside a railroad line that runs north/south. A short spur extends from the main line into the fertilizer plant property to facilitate delivery of raw materials by rail car.

The fertilizer processing building was located approximately 230 yards from West Intermediate School and 400 yards from West High School. An apartment complex and nursing home facility were located approximately 175 yards and 250 yards respectively to the west of the fertilizer building. Single-family homes surrounded the plant property with the largest number of homes to the west and south. Two single-family homes were located across the roadway on the east side of the plant entrance and one single-family home was adjacent to the north end of the plant property.

According to the McLennan County Appraisal District database, Adair Grain, DBA West Fertilizer, was located on a portion of property that was outside the jurisdictional boundaries of the incorporated City of West, within McLennan County, and which

contained the fertilizer storage building. West Fertilizer Company also occupied property on a contiguous lot that was located within the city limits of West.

West Fertilizer showing the city limits, the processing building (red circle), and railroad tracks

Structure

The West Fertilizer Plant bulk processing building had an estimated floor area of 12,000 square feet. Most of the building was one story in height with the exception of the vertical storage bins (one of which was for ammonium nitrate) and associated conveyor and elevator equipment, which were multiple stories in height. The building construction was classified as Type-V 000 wood frame with no fire resistance rating for supporting structural members, in accordance with ***NFPA 220, Standard on Building Construction***. The internal structural elements were mostly exposed to the interior without a finished covering. Various materials were used for the exterior covering, including tin sheathing, wood siding and possibly some fiberglass materials. The structure was built on a reinforced concrete slab foundation under a combination roof consisting of asphalt shingles, asphalt roll-roofing materials or corrugated sheet metal.

The north end of the building was an area referred to as the "seed room" where several hundred 50-pound bags of seed stacked on pallets were stored. The pallets were placed adjacent to the vertical ammonium nitrate (AN) bin. The pallets were separated from the AN bin by a wood frame wall. Several hundred 50-pound bags of 36 percent dry zinc were stored in the seed room along with other general farm and ranch hardware.

Building Service

The building utility services were all electric. No natural gas or propane gas was provided to the buildings. The main power supply to the facility was located at, and attached to, the northeast portion of the fertilizer structure.

Building Contents and Operations

Ammonium nitrate with 34 percent total nitrogen content, also referred to as 34-0-0 (with 97 percent pure ammonium nitrate), was stored in bulk granular form in an open system consisting of a vertical bin constructed of wood walls approximately 24 feet high.

The bin contained an estimated 20-30 tons of ammonium nitrate. An air conditioner was installed to maintain low humidity levels and reduce "shrinkage loss" and caking of the ammonium nitrate product in the vertical bin. Investigators determined through interviews of the employees that the air conditioner was not in use the day of the incident.

View of the building from the northeast

Ammonium nitrate was also stored in two smaller bins located along the west wall of the building. Separation from adjoining storage bins was accomplished by 10 foot high wood framing and plywood walls. Only one of the smaller bins contained ammonium nitrate on the day of the incident, estimated at 20-30 tons. The remaining bins stored potash, ammonium sulfate, diammonium sulfate, and KMAG – a mixture of potassium, magnesium, and sulfur. A second vertical storage bin was present in the building, but it had been abandoned years before.

The basic operation of the facility was to "custom blend" fertilizer to the customer's desired formula. The finished product was loaded into applicator vehicles for delivery to the specified location. The blending and delivery machinery was located under an awning on the east side of the building.

East side of the processing building where the mixing and delivery of chemicals occurred

Using the classification methods defined in ***National Fire Protection Association 400***, Ammonium Nitrate 34 percent is classified as a solid class 3 oxidizer and an unstable reactive class 3 detonable.

These classifications are confirmed by the Hazardous Material Expert Assistant (HMEX) version 4.0.0 software output (See HMEX categorization output chart in Appendix, page 55) which is commonly used to classify hazardous material in the categories used by the International Fire Codes, which are the same as those in ***NFPA 400*** for this material.

- ***3.3.61.10* Unstable (Reactive) Material.*** *A material that, in the pure state or as commercially produced, will vigorously polymerize, decompose or condense, become self-reactive, or otherwise undergo a violent chemical change under conditions of shock, pressure, or temperature.*

- ***3.3.61.10.3* Class 3 Unstable (Reactive).*** *Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation.*

- ***3.3.72* Oxidizer.*** *Any solid or liquid material that readily yields oxygen or other oxidizing gas or that readily reacts to promote or initiate combustion of combustible materials and that can, under some circumstances, undergo a vigorous self-sustained decomposition due to contamination or heat exposure.*

- ***3.3.72.3 Class 3.*** *An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes into contact or a solid oxidizer classified as Class 3 when tested in accordance with the test protocol set forth in* G.1.

Exemplar Material Safety Data Sheets for ammonium nitrate reference the material as "unstable" under high temperature and when exposed to fire and incompatible materials or confinement. [2]

[2] ***Obtained from the MSDS Sheet for material supplied to West Fertilizer from CF Industries:***
HAZARDS IDENTIFICATION
EMERGENCY OVERVIEW
Strong oxidizer. *Contact with combustible material will increase fire hazard. May undergo detonation if heated under confinement causing pressure buildup or if subjected to strong shocks. Solid AN when sensitized or during decomposition may become unstable and/or explosive. When AN is heated to decomposition it may produce vapors which contain nitrogen oxides (NOX).* ***AN is an oxidizer*** *and as such may increase the flammability and/or explosiveness of other substances. Use water to control fires involving AN, if water is compatible with burning material. AN itself is non-flammable. AN can cause irritation to eyes and skin and may be an inhalation discomfort in confined locations.*
NFPA Hazard Classification Health Hazard (Blue)……. 1
Flammability (Red)…… 0
Reactivity (Yellow)…….. 3
Other ……OX

Fire Prevention Code Features

Fire prevention code compliance is generally determined by locally adopted codes and ordinances established by the municipality as the authority having jurisdiction within the community. However, the City of West does not have an adopted fire code or personnel that conduct fire and life safety inspections within their jurisdiction. Planning and zoning ordinances are determined by the local authority having jurisdiction.

In preparing this report, the ***National Fire Protection Association (NFPA) 1, Fire Code, 2012 Edition***, was referenced as a guide for evaluating the building fire safety features. Similar provisions can be found in the ***International Fire Code*** as well. In utilizing this reference document, the incident building is initially classified as storage occupancy. The primary hazardous material is 97 percent pure ammonium nitrate (34-0-0) which is classified according to its physical hazards as a Class 3 unstable reactive detonable (UR3D) and Class 3 oxidizer as described above. The base maximum allowable quantity for a UR3D solid is 5 pounds per ***NFPA 1 Chapter 60, Hazardous Materials***, Table 60.4.2.1.1.3. Because this MAQ was exceeded, the building was classified as a high-hazard protection level 1 occupancy, per the same table. ***NFPA 1 Chapter 74, Ammonium Nitrate***, requires ***NFPA 400*** to be utilized for ammonium nitrate containing more than 60 percent ammonium nitrate.

The following requirements are from ***NFPA 400:***

- ***5.3.3.1 and 11.1.5 Construction Type.***

  Per building code (IBC), type V-B (or V-000 per **NFPA 220***) is not allowed. Minimum permissible construction type is V-B or (V-111 per* **NFPA 220***) where structural members are provided with a fire resistance rating.*

- ***6.2.1.1.3 and 6.2.1.11 Fire Alarm.***

  Waterflow alarms shall be monitored.

- ***6.2.2.2 Detached Building Required.***

  Buildings shall be used for no other purpose (than storage of ammonium nitrate).

- ***11.2.6 Automatic Fire Sprinklers.***

  Automatic fire sprinklers are required.

- ***11.2.6.2.1 Portable Fire Extinguishers.***

  Portable extinguishers shall be provided throughout the storage area and in the loading and unloading areas in accordance with the fire prevention code adopted by the jurisdiction and **NFPA 10, Standard for Portable Fire Extinguishers**.

- ***11.2.12.1 Separation.***

  Ammonium nitrate shall be separated by fire barrier walls of not less than 1-hour fire resistance or located in a separate building from the storage of any of the following:

  (1) Organic chemicals, acids, or other corrosive materials

  (2) Compressed flammable gases

(3) Flammable and combustible materials, solids or liquids

(4) Other contaminating substances, including the following:

(a) Wood chips

(b) Organic materials

(c) Chlorides

(d) Phosphorus

(e) Finely divided metals

(f) Charcoals

(g) Diesel fuels and oils

- ***11.2.12.1.1***

  Walls shall extend from the floor to the underside of the roof above. In lieu of fire barrier walls, ammonium nitrate shall be permitted to be separated from the materials by a space of at least 30 ft (9.1 m) or more, as required by the AHJ, and sills or curbs shall be provided to prevent mixing during fire conditions.

- ***11.2.12.2 Incompatible Materials.***

  Flammable liquids, such as gasoline, kerosene, solvents, and light fuel oils, shall not be stored on the premises, unless the following criteria are met:

  (1) The storage conforms to **NFPA 30, Flammable and Combustible Liquids Code**.

  (2) Walls and sills or curbs are provided in accordance with ***11.2.12.1.1*** *through* ***11.2.12.1.3***.

  11.2.12.2. *LP gas shall not be stored on the premises, unless such storage conforms to* **NFPA 58, Liquefied Petroleum Gas Code**.

- ***11.3 Indoor Storage.***

  Storage Conditions/Arrangement. *Storage arrangement shall be in accordance with* ***11.3.2.1 through 11.3.2.3.***

- ***11.3.2.1 Containers.***

  Bags and containers used for ammonium nitrate shall comply with the specifications and standards established by the U.S. Department of Transportation (DOT).

- ***11.3.2.2 Piles of Bags, Drums, or Other Containers.***

  Containers of solid ammonium nitrate shall not be placed into storage when the temperature of the ammonium nitrate exceeds 130°F (54.4° C).

  Bags of ammonium nitrate shall not be stored within 30 in. (762 mm) of the walls and partitions of the storage building.

  Piles shall comply with the following dimensions:

  (1) The height of piles shall not exceed 20 ft (6.1 m).

  (2) The width of piles shall not exceed 20 ft (6.1 m).

  (3) The length of piles shall not exceed 50 ft (15.2 m), unless otherwise permitted by **NFPA 400 11.3.2.2.3(4).**

  (4) Where the building is of noncombustible construction, or is protected by automatic sprinklers, the length of piles shall not be limited.

In no case shall the ammonium nitrate be stacked closer than 3 ft (0.9 m) below the roof or its supporting overhead structure.

Aisles shall be provided to separate piles by a clear space of not less than 3 ft (0.9 m) in width, with at least one service or main aisle in the storage area not less than 4 ft (1.2 m) in width.

- ***11.3.2.3.3 Piles of Bulk Solid Storage.***

  Warehouses shall have ventilation, or be capable of ventilation in case of fire, that will, in the event of a fire, prevent the explosive decomposition of ammonium nitrate.

  Buildings shall be ventilated so as to prevent confinement of decomposition gases.

  Bulk storage structures shall not exceed a height of 40 ft (12.2 m).

  Where bulk storage structures are constructed of noncombustible material and facilities for fighting a roof fire are provided, the height of the storage building shall only be limited by the building construction type as specified in the building code adopted by the jurisdiction.

- ***11.3.2.3.4 Compartments.***

  Bins shall be clean and free of materials that can contaminate ammonium nitrate.

  Due to the corrosive and reactive properties of ammonium nitrate, and to avoid contamination, galvanized iron, copper, lead, and zinc shall not be used in bin construction, except where such bins are protected against impregnation by ammonium nitrate.

  Aluminum bins, and wooden bins protected against impregnation by ammonium nitrate, shall be permitted.

  The warehouse shall be permitted to be subdivided into any desired number of ammonium nitrate storage compartments or bins.

  The partitions dividing the ammonium nitrate storage from the storage of other products that would contaminate the ammonium nitrate shall be constructed to prevent the ammonium nitrate from becoming contaminated.

  The ammonium nitrate storage bins or piles shall be clearly identified by signs reading AMMONIUM NITRATE with letters at least 2 in. (50.8 mm) high.

  Piles or bins shall be sized and arranged so that all material in the pile is able to be moved out in order to minimize possible caking of the stored ammonium nitrate.

  The height or depth of piles shall be limited by the pressure-setting tendency of the product; however, in no case shall the ammonium nitrate be piled higher at any point than 3 ft (0.9 m) below the roof or its supporting and overhead structure.

  Ammonium nitrate shall not be placed into storage when the temperature of the product exceeds 130°F (54.4°C).

  Dynamite, other explosives, and blasting agents shall not be used to break up or loosen caked ammonium nitrate.

- ***11.3.3 Floors.***

  All flooring in storage and handling areas shall be without open drains, traps, tunnels, pits, or pockets into which any molten ammonium nitrate is able to flow and be confined in the event of fire.

Uniform Building Code (UBC) 1961

The code of record used when the building was originally constructed is not known but ***UBC 1961*** was available and commonly used at the time.

Per ***UBC 1961***, the building would have been classified as an F-2 occupancy. The basic allowable height and area provisions based on the occupancy and construction type were met (6,000 square feet base with 33 1/3 percent increase to 8,000 square feet for fire zone 3 (rural – no conflagration hazard) and a 100 percent area increase to 16,000 square feet for frontage). The ~12,000 square feet structure would have complied. There was not a requirement in place for sprinklers at the time. Fire code provisions were not reviewed because the first edition of ***NFPA 1, Uniform Fire Code,*** was not published until 1971.

Fire Investigation

The following information is provided by the SFMO and the ATF investigation teams.

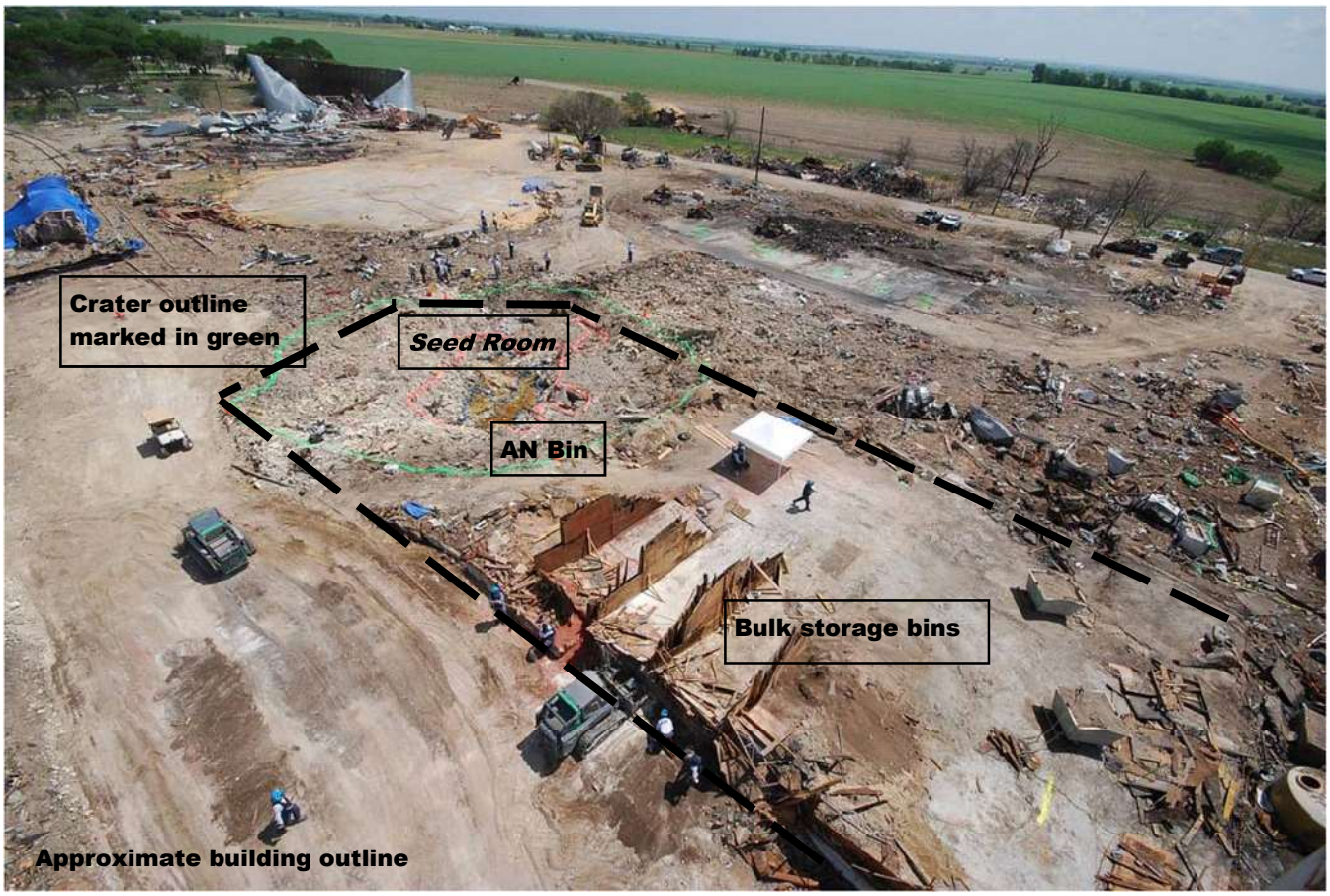
The fire and subsequent explosion on April 17, 2013, at the West Fertilizer Plant in West, Texas, was investigated by the SFMO, ATF and other local, state and federal law enforcement agencies in accordance with the statutory authority of Texas and federal laws. The majority of the scene investigation was completed in the 31 days following April 17, 2013; however, investigators remained on the ground and assigned to the area of the scene for a total of 38 days.

A unified command system between the SFMO and ATF was established at the onset of the investigation. The SFMO received control of the scene from McClennan County's incident commander. Although exigent circumstances existed at the time of the incident and for a period of time following the incident, the SFMO obtained two evidentiary search warrants to conduct the origin-and-cause investigation. The SFMO, in conjunction with the ATF, had control of the scene. The final report regarding the origin-and-cause investigation, although not complete at this time, has been a joint effort between the SFMO and ATF.

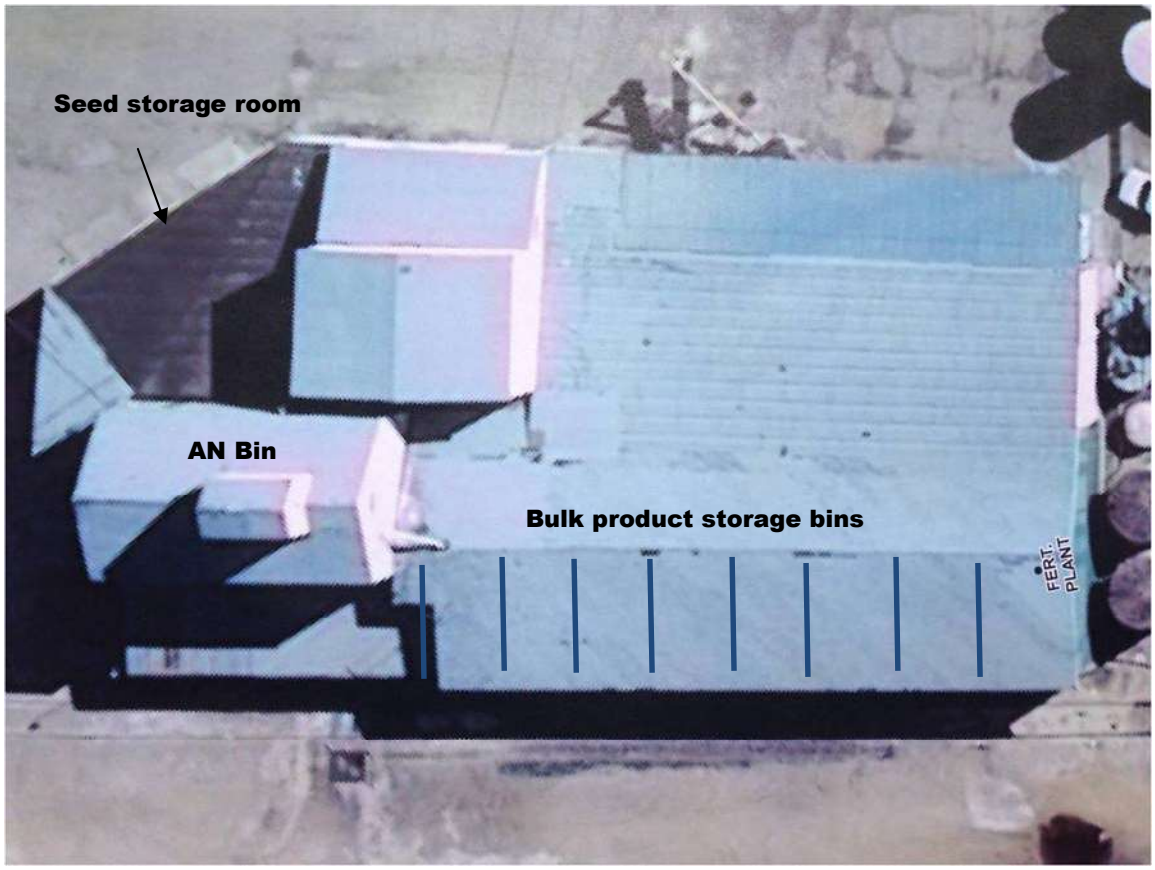
View of the site prior to scene excavation and examination

Throughout the initial 31 days, investigators conducted over 200 interviews, searched for evidence in a 37-block area, and excavated the entire 14 acres of the fertilizer facility, documenting, measuring, and securing hundreds of pieces of evidence. Additionally, reconstruction, to the extent possible, was completed. After more than 20,000 personnel hours were worked by more than 100 investigators from the SFMO and ATF, and prior to the final press briefing on May 16, 2013, several possible causes of the fire were eliminated; however, multiple potential causes could not be eliminated. As a result, at the time of publication of this firefighter fatality investigation report, the investigation is on-going, "open" and the cause of the fire at the West Fertilizer facility remains undetermined.

Despite the cause of the initial fire being undetermined, the SFMO and ATF continue to scientifically test and investigate factors and circumstances surrounding the cause of the fire. Forensic testing has already occurred, and will continue, at the ATF Fire Research Laboratory in Maryland. Upon completion of the testing and investigation, a formal report will be prepared by the ATF.

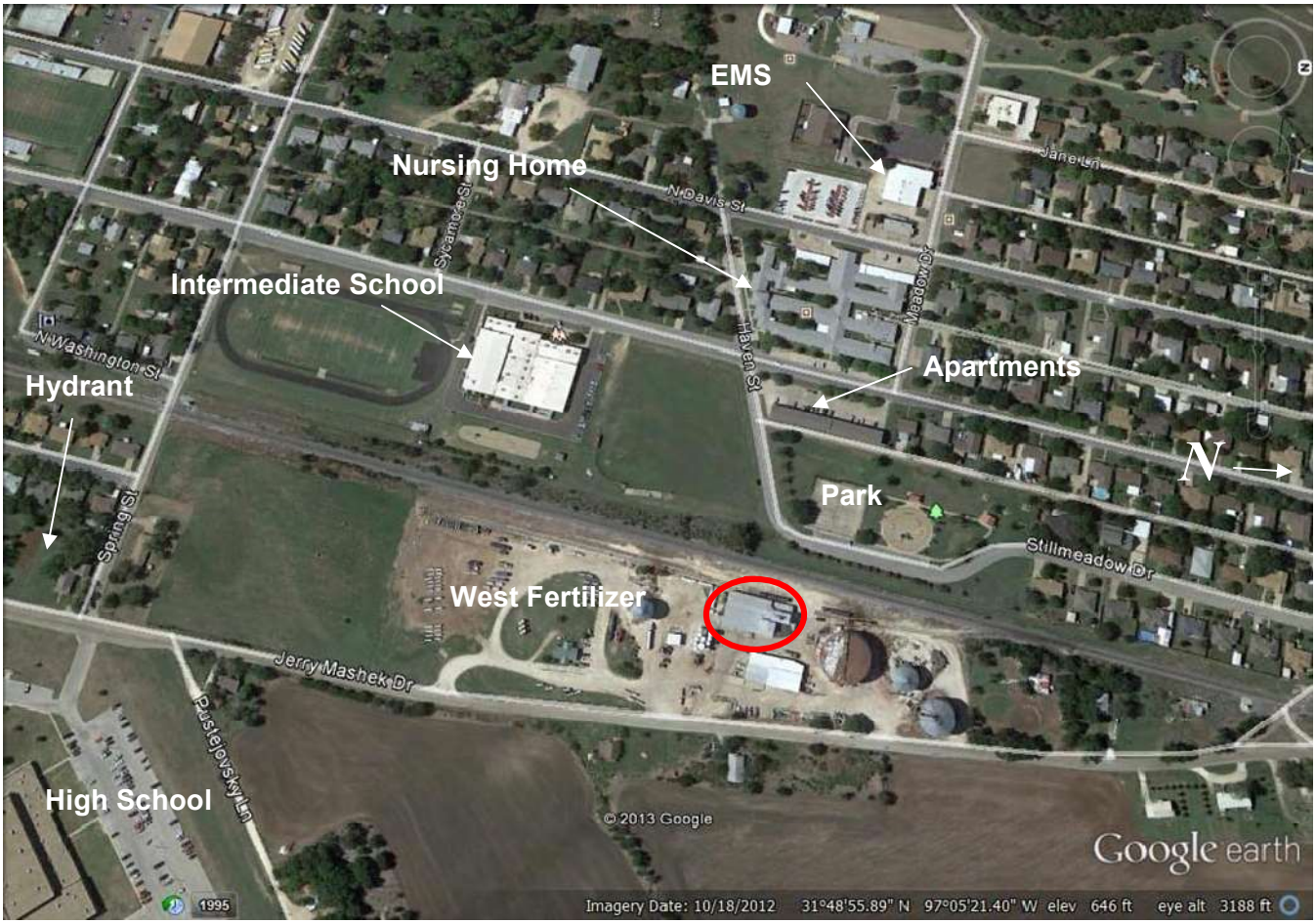


View of the scene during the examination and reconstruction



Comparison photos of the reconstruction and pre-blast photos of the processing building

Fireground Operations and Tactics



Google Earth view showing streets, schools, apartments, nursing home, and the EMS building

The following information is provided by the SFMO investigation teams. The following sequence of events was developed from radio transmissions, photographs, video, firefighter statements and witness information. Those events with known times are identified. Events without known times are approximated in the sequence of the events based on firefighter statements regarding their actions and/or observations.

Weather at the time of the fire was partly cloudy with winds from the east-southeast at 5-10 mph.

19:29:19 The McLennan County Sheriff's Office received a 911 call reporting a fire at the West Fertilizer Plant. The West Fertilizer Plant was located at 1471 Jerry Mashek Drive in West, Texas. The caller was located in the park, west of the plant, across the railroad tracks.

19:31:44 West PD Officer Michael Irving (West PD 209)was on patrol on Haven Street, near the public basketball courts, west of the West Fertilizer Plant, and smelled wood burning. As he drove through the area and saw several kids playing basketball, one young man approached the patrol car and pointed toward the fertilizer plant and said, "Smoke is coming from the tall building of the fertilizer plant." Officer Irving reported to Dispatch on the radio and stated "Kick out West Fire. One of the mills at the West Fertilizer Plant is on fire; heavy smoke coming out of the roof."

19:32:28 West VFD was dispatched and the dispatcher stated "a fire call at West Fertilizer Plant, they have a fire out there, again." And the dispatcher repeated the information. "Again" was routinely used by dispatch to indicate a repeat of the information.

The elapsed time from the receipt of the initial 911 call to the dispatch of West VFD was three minutes and nine seconds.

C.J. Gillaspie, Douglas Snokhous, and Cody Dragoo exited the Exxon Station and looking north could see the "billowing white smoke coming from the plant." Cody Dragoo, who oversaw the operations of the bulk processing building at the West Fertilizer Company, responded directly to the scene in his personal vehicle. Captain Gillaspie and Doug Snokhous responded, in separate personal vehicles, to the West Fire Station.

West PD Officer Irving knew the building on fire contained fertilizer. After notifying Dispatch of his initial observations, Irving turned on his emergency lights and continued north through the residential neighborhood on Stillmeadow Drive, east on Grady Calvery Drive and back south on Jerry Mashek Drive toward the plant's north entrance. From inside his patrol car, he observed "thick" smoke coming out of the north end of the building. He positioned his car on Jerry Mashek Drive and exited his vehicle. From this vantage point he could see orange-red flames coming through the wall above the lower level roof at the north end of the building. He did not notice any smoke or flames below the lower level roof. While outside his patrol car he notified Dispatch that there was a structure fire with visible flames at the fertilizer plant.

19:34:13 West Fire was notified by Dispatch: "PD on scene advises one of the mills is on fire."

19:35.33 West PD 209 called for contact numbers for the fertilizer plant. He was given numbers for two individuals.

19:36:44 West Fire was notified by Dispatch that West PD can see flames "coming out."

19:37:03 Engine 1, driven by Firefighter Joey Pustejovsky, Jr., and staffed by Captain Bob Snokhous and Firefighter Morris Bridges, reported en route followed by Engine 2 driven by Captain C.J. Gillaspie and staffed by Firefighter Eddie Hykel.

As he approached the scene from the south, Firefighter Pustejovsky radioed West PD 209 and asked him to block traffic. The two vehicles passed each other on Jerry Mashek Drive.

Realizing the kids playing basketball needed to be evacuated, West PD 209 continued south on Jerry Mashek Drive, west on Spring Street, and back north on Haven Street toward the park area. Without stopping or exiting his vehicle, he utilized his PA system to tell the kids to get back. At the same time, he observed heavy smoke coming from the "bell tower" of the fertilizer plant. He then retraced his earlier clockwise route back to the north end of Jerry Mashek Drive.

The white brush truck, driven by Captain Doug Snokhous; the water tender, driven by Fire Chief George Nors Sr.; and later, the red brush truck driven by Pat Grimm with Firefighter Stevie Vanek were en route to the West Fertilizer Plant.

Passerby view of the east side of the building, approximate time 7:38 p.m. (Photo by Macik)

Passerby view of Engine 1 position at east side of building, approximate time 7:40 p.m. (Photo by Campbell)

19:39:18 Engine 1 arrived on scene "with flames" and asked Engine 2 to hook to a hydrant. Engine 1 pulled one 1½ inch hand line from the bumper and one 1½ inch cross-lay hand line and began to attack the fire from outside through a sliding door located on the east side of the structure near the north end. The door was reportedly closed and locked when the plant was closed, as a normal course of business.

At an unknown time, the white brush truck, driven by Captain Douglas Snokhous, arrived at the north end of the plant and positioned the truck at the northwest corner of the office building under electric service lines, northeast of the bulk processing plant. Captain Snokhous deployed at least one 1½ inch hand line.

West PD 209 stopped briefly at the north end of Jerry Mashek Drive to block traffic and observed a red fire engine that he believes was Engine 2 at the intersection of Jerry Mashek Drive and Spring Street. He then enlisted the resident of a nearby home to use his personal vehicle to block traffic on the north end of Jerry Mashek Drive.

West VFD Firefighter Kirk Wines first noticed the structure fire as he exited his shop at his residence. He had heard the initial page but was unable to understand the message. He remained in his shop until he heard radio traffic asking for assistance blocking traffic at the high school. Firefighter Wines left his shop and saw West VFD firefighters Kevin Maler and David Maler. David Maler was also a McLennan County Constable. Firefighter Wines informed the brothers of the fire and the three responded to the fire in separate personal vehicles.

The white brush truck was positioned under the electric service lines in this area before moving back
(Insurer photo)

Engine 2, driven by Captain Gillaspie, arrived at the intersection of Jerry Mashek Drive and Spring Street, approximately 1600 feet south of the plant entrance, and dropped a 4-inch hose supply line. Firefighter Hykel helped to lay out the 1000 feet of 4-inch hose for connection. Captain Gillaspie was aware that the 1000 feet of hose would not be sufficient to reach the fire building. He planned to forward lay all of the supply line off of Engine 2 and reverse lay the 4-inch hose off Engine 1 to complete the lay before returning to the hydrant to charge the line.

West PD 209 relocated his patrol vehicle to the south intersection of Jerry Mashek Drive and Spring Street, facing Pustejovsky Lane, in order to block Jerry Mashek Drive. Once he arrived there, he realized Engine 2, which he had observed from the other end of Jerry Mashek Drive, was no longer at that location.

After deploying all 1000 feet of 4-inch hose supply line from Engine 2, Firefighter Hykel stayed at the end of the 1000 feet of hose supply line as Captain Gillaspie drove to the location of Engine 1 and parked behind it. Captain Gillaspie ordered the Engine 1 crew to disconnect the bumper hose line as he threw the cross-lay hose line on top of the truck. Captain Gillaspie intended to finish laying the supply line in a reverse lay back to Firefighter Hykel's location and then use Engine 1 at the hydrant. Engine 2 was turned over to the crews that were operating Engine 1.

19:40:16 McLennan County Sheriff's Office contacted Dispatch by 911 and relayed a message to request mutual aid from the Abbott VFD.

West Assistant Fire Chief Emanuel Mitchell arrived in his personal vehicle and parked on Jerry Mashek Drive and walked to the plant to meet with Captain Cody Dragoo. Chief Mitchell did not report that he was on scene. West VFD Captain Cody Dragoo and West PD Officer Irving were already on scene. Dragoo stated the seed room was on fire. Mitchell did not formally assume command.

19:41:50 Assistant Chief Mitchell called McLennan County Sheriff's Office Dispatch by phone and requested Lacy Lakeview to bring a ladder truck.

West VFD Firefighter David Maler arrived on scene in his personal vehicle from the south. Firefighter Maler said that he drove past the southeast entrance of the plant and parked his pickup across the northeast entrance to discourage civilians from entering. Firefighter Kevin Maler arrived at the same time as David Maler and told David that he would drive to the West Fire Station and pick up their turn out gear.

Before Firefighter Kevin Maler left the area he received a phone call from Brian Renegar. Renegar is a former West VFD firefighter and former West Fertilizer Plant employee. Renegar advised that they needed to evacuate the plant to at least a quarter-mile distance because of the risk of explosion.

View of the site from the northeast (Photo by Wright)

Firefighter David Maler left his vehicle at the northeast entrance and walked toward the fire. Firefighter Maler walked to the white brush truck parked between the office building and a large, round storage elevator. Firefighter Maler told Captain Doug Snokhous to move the white brush truck because it was beneath power lines. The power lines had already fallen at one end where they connected to the north side of the bulk processing building. Captain Doug Snokhous moved the white brush truck back toward the east as Firefighter Maler assisted by pulling the hose line back with the truck. Firefighter Maler told investigators the hoses were easy to move and seemed like they had not been charged with water. Firefighter Maler then walked along the east side of the office building to the south end where he could assist the other firefighters.

Dallas Fire-Rescue Captain Kenneth Harris arrived on scene and talked with Firefighter David Maler, Captain Dragoo, and Assistant Chief Mitchell. After Harris introduced himself as a Dallas firefighter he asked if he could offer some advice. When he was told to do so, Harris stated he believed the building was a lost cause and should be "written off." Harris told Dragoo and Mitchell to concentrate on flowing water on the anhydrous ammonia tanks south of the building, once a water supply was established.

Firefighter Maler turned to Captain Dragoo, and asked what kind of dangerous items were in the building that they needed to contend with. Captain Dragoo stated there was a large amount of ammonium nitrate in the building but "it could never get hot enough for it to go off."

During interviews, Assistant Chief Mitchell recalled asking Captain Dragoo where the fertilizer was located. Dragoo replied that the fertilizer and chemicals were far enough away from the fire to not be of concern. Dragoo stated the fire would not get to that point. Mitchell recalled suggesting and saying out loud that they "needed to go." However, Mitchell did not give an order to withdraw. Mitchell recalled making a mental note that he had never witnessed a fire burn that fast.

Firefighter David Maler stated that he saw Engine 2 reposition from the east side of the bulk processing building. He stated that he heard gears grinding while the truck was moved. Engine 2 was positioned facing to the north, southwest of the office building.

The 2000-gallon water tender driven by Fire Chief George Nors, Sr., arrived and parked on the roadway near the east entrance. Chief Nors did not report his arrival. He got out of the water tender as Brian Renagar drove by. Renegar stopped briefly and told Chief Nors that he should get everyone out, that it's "gonna blow." Chief Nors did not take command. Chief Nors approached Captain Dragoo and told him what Renegar had said about leaving because of the risk of explosion. Dragoo said he didn't think an explosion would happen. Chief Nors turned and walked back toward the water tender. Chief Nors did not give an order to withdraw.

Engine 1, now driven by Captain Gillaspie, who had intended to reverse lay the 4-inch hose supply line to the point where the initial 1000 feet of 4-inch hose supply line from Engine 2 ended, drove to the hydrant but forgot to reverse lay the 4-inch supply hose. Gillaspie positioned Engine 1 at the hydrant located on Jerry Mashek Drive near the intersection with Spring Street, facing north toward the West Fertilizer Plant. West VFD Firefighter Marty Marak was there and connected to the hydrant even though the supply line was not finished.

West Emergency Medical Services Paramedic Coil Conaway overheard radio traffic requesting mutual aid from Abbott Fire Department. Conaway and EMT April Conaway were on duty assigned to Medic 2 at the West EMS building located in the residential neighborhood west of the fertilizer plant.

19:45:50 West EMS Medic 2 notified East Texas Medical Center of their response to the fire. An EMT class was in progress at the time of the call with students that included area fire department firefighters. EMT student Kevin Sanders, a firefighter from the Bruceville-Eddy Volunteer Fire Department, was assigned to Medic 2 as part of the EMT class ride-out requirements for the course and responded to the fire scene aboard Medic 2.

Abbott Volunteer Fire Department firefighters Jerry Chapman and Cyrus Reed, and Mertens/Navarro Mills Volunteer Fire Department Firefighter Perry Calvin were students in the EMT class at the West EMS building when the call for mutual aid was transmitted. All three firefighters responded to the fire scene in personal vehicles.

19:47:00 Medic 2 arrived on scene and parked near the scale house, located approximately 600 feet southeast of the bulk processing building.

View from the north at approximate time 7:48 p.m. (Photo by Bajer)

Paramedic Conaway contacted West VFD Assistant Chief Emmanuel Mitchell. Conaway, suspecting chemical involvement and toxic smoke, asked Mitchell if any evacuations had begun. Mitchell indicated that no evacuations had been ordered. Conaway radioed Dispatch and instructed them to call the West EMS building and have the remaining students respond and begin evacuating a nursing home.

Kevin Sanders left Medic 2 and walked toward the structure fire. Conaway tried to prevent Sanders from leaving the unit but was unsuccessful.

Firefighters Chapman, Reed, and Calvin arrived in their personal vehicles. They parked southeast of the plant and walked past Medic 2 toward Engine 2. Conaway stated that he recalled one of the firefighters wearing turn out gear.

West VFD Firefighter Robbie Payne arrived on scene and observed several unidentified firefighters and a civilian, Jimmy Matus, an employee of Westex. Westex manufactures fire apparatus. It was not unusual for Matus to respond to fire scenes with West VFD to assist in the operation of the apparatus. Firefighter Payne stated he remembered seeing other firefighters on the scene and thought they were spraying water but later said he was not certain of that. Payne stated that he was on scene for less than one minute before the explosion occurred. From his vantage point on the east side of the office building, he wasn't able to observe all of the activities taking place.

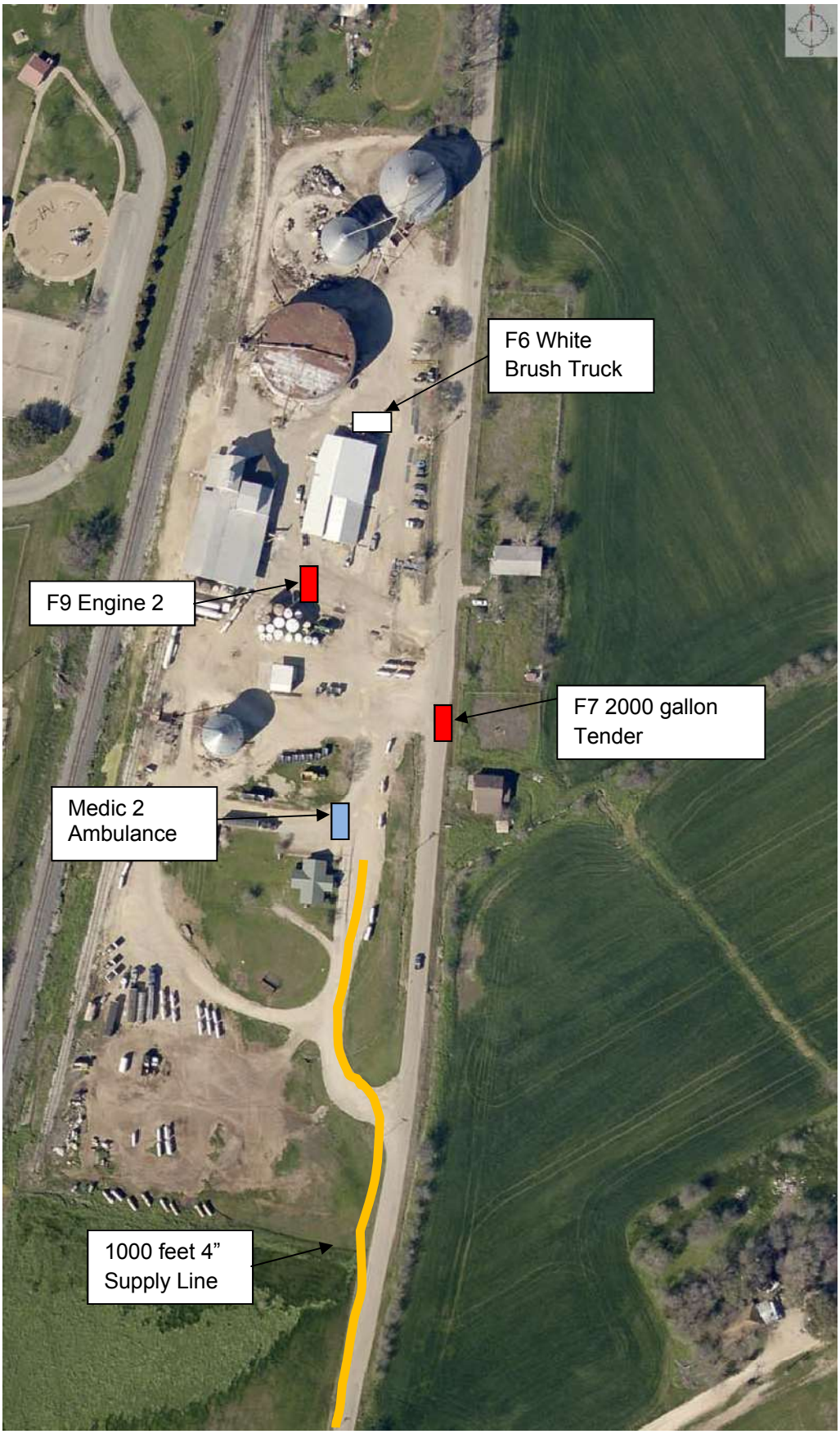
View from the southeast at approximate time 7:50 p.m. (Photo by Nathan Nors)

View of the plume of smoke after the explosion
(Photo by Kapavik)

19:50:24 Assistant Chief Emanuel Mitchell called back to McLennan County Sheriff's Office Dispatch via cell phone and asked, "Did you notify Abbott Fire and Lacey Lakeview Fire and tell them to keep coming?"

The explosion occurred at approximately 7:51 p.m.

Captain Gillaspie and Firefighter Marak were in the process of making the connection from the hydrant to Engine 1 when the explosion occurred.



Approximate positions of apparatus at time of explosion

Personal Protective Equipment

The Texas Commission on Fire Protection (TCFP) conducted an evaluation of the firefighters' personal protective equipment for performance of and compliance with TCFP rules. Examination of the Personal Protective Equipment (PPE) used in this incident may provide important information related to the incident. The following are excerpts of the TCFP evaluation report.

The examination of the PPE and the investigation of the incident revealed that the PPE worn by the responding personnel did not affect the outcome of the incident and was not a contributing factor in the deaths of the firefighters.

TCFP compliance officers Lamar Ford and Bob Manley traveled to the city of West, Texas, to assist the SFMO with the investigation of the firefighter fatalities that occurred on April 17, 2013.

West Volunteer Fire Department (VFD) is a volunteer fire department and does not fall under the jurisdiction of the TCFP and is not required to abide by the rules and standards of the TCFP.

In the interview with the West fire chief, the following information was requested:

- PPE records (annual inspections)
- Self contained breathing apparatus (SCBA) records (annual flow test)
- Records of the last hydrostatic test (air cylinders)
- Standard operating procedures (SOPs) required in Chapter 435 of the Texas Administrative Code
- Training or CE records, for each of the fallen, between May 31, 2012, and May 31, 2013, or since employment began

These five items are part of the biennial inspection process for paid, regulated fire departments in the state of Texas.

The West VFD fire chief explained that there were no PPE or SCBA records available and it was not the usual practice of West VFD to have the annual PPE inspection or the SCBA flow test done.

The department had purchased some new cylinders within the last year when it was discovered some cylinders were out of date during the refill process.

There are no records of hydrostatic test dates on file.

The West VFD does not have any written standard operating procedures or guidelines.

Available training records were provided by each department. Records included the State Firemen's and Fire Marshals' Association (SFFMA) training objectives report for each victim belonging to the West VFD or copies of certificates of training attended.

Findings and Recommendations

These recommendations are based upon nationally recognized consensus standards and safety practices for the fire service. Volunteer fire departments in Texas and all firefighting personnel should know and understand nationally recognized consensus standards. Fire departments should create and maintain SOGs and SOPs to ensure effective, efficient, and safe firefighting/training operations.

This portion of the document contains the most significant lessons learned and best-practice recommendations of the SFMO Firefighter Fatality Investigation Task Force. This report is intended to focus attention on the points that could have the greatest impact on preventing similar and future firefighter fatalities. The purpose of the recommendations portion of this document is to provide fire departments with a reference that will enable them to proactively plan for and engage future and similar emergency events to maximize the chances for a successful and safe outcome.

The West Fertilizer Company was a high-risk commercial business that presented specific risks to the health and safety of firefighters. The fire risk factors that were found in this occupancy also presented risks to the employees, customers, neighbors, and the surrounding community.

Fire Department Operations

The lack of adherence to nationally recognized consensus standards and safety practices for the fire department exposed firefighters to excessive risks and failed to remove them from a critically dangerous situation. The strategy and tactics utilized by the West Volunteer Fire Department were not appropriate for the rapidly developing and extremely volatile situation, and exposed the firefighters to extreme risks.

The predominant factors identified in the analysis of fire department operations included the following:

(1) There was no incident command system and senior ranking members did not perform supervisory roles.

(2) The essential duties of an incident commander were not performed.

(3) The emergency scene operation was conducted in an unstructured and uncoordinated manner, without overall direction and without adequate supervision.

The West VFD was not trained or equipped to conduct an operation of this complexity, involving a large commercial occupancy filled with hazardous materials that possessed explosive properties. Firefighters were committed to attacking a fire that was significantly beyond the extinguishment stage, with few resources and a limited water supply. The volume of fire could not be controlled by the limited flow that would have been available from the small hose lines that were deployed. The West Fertilizer Company fire required a drastically different combination of strategy and tactics than those expected or acceptable for fighting a residential fire. However, the application of water during extinguishment attempts was not a contributing factor to the explosion.

Residential fire attack approaches are highly effective in controlling a large percentage of most structure fires and were likely effective in controlling a large percentage of the fires the West VFD had encountered over the years. However, for a large and complicated commercial occupancy, alternative firefighting strategies must be considered early and reassessed continuously throughout the incident.

Firefighting is not an exact science, and through post-incident analysis of most emergency incidents, it is not unusual that a number of performance problems are identified. The final analysis of this incident does not suggest the firefighters who lost their lives, or any surviving members of the West VFD, failed to perform their duties as they had been trained, or as expected, by their organization.

The analysis does, however, indicate a systemic deficiency in the training and preparation of the West VFD to adequately prepare for the incident they encountered at the West Fertilizer Company fire.

Had best practices been followed, the situation that occurred in West, Texas, on April 17, 2013, could have been prevented. The findings and recommendations listed below are re-statements of lessons that have been identified in previous investigations of firefighter fatalities, and recommendations that have been widely adopted as standard practices within the fire service.

Finding 1: Standard Operating Procedures

The initial responding fire department did not have standard operating procedures (SOPs) or standard operating guidelines (SOGs) for emergency operations.

Recommendation:

Specific SOPs/SOGs should be developed, and members trained and educated regarding firefighting and emergency scene strategies and tactics for responding to high-hazard or high-risk occupancies.

References:

Texas Commission on Fire Protection Standards Manual, Chapter 435, Section 435.15, Part (a)*: The fire department shall develop, maintain and use standard operating procedure for fire protection personnel operating at emergency incidents.*

Command and Control of Fires and Emergencies (Dunn), Fire Engineering Books Publishing, ***page 63****: Standard operating procedures. A standard operating procedure provides accountability and control. It is a general plan of who does what and where. It lets companies know where they should be operating and what they should be doing.*

Finding 2: Pre-fire Planning

There was no pre-fire or pre-incident plan of this facility.

Recommendation:

Fire departments should visit and pre-incident plan responses to commercial structures in their jurisdiction. It is imperative that high-risk occupancies containing hazardous materials are identified and appropriate emergency response strategies and tactics are developed through pre-plan documents and SOP directives. High-hazard and high-risk occupancies containing heavy fire loads and hazardous materials should be well defined and all members made aware of their potential dangers. This will better prepare them for the hazards which may be found in the event of a fire and also provide them with insight as to when it is prudent to attack a fire or evacuate the area.

References:

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 43:*** *Establishing SOPs is the first step in the size-up. Pre-incident planning is step two. After SOPs are developed, individual properties should be examined for specific hazards and characteristics. Pre-incident plans are a natural extension of SOPs.*

NFPA 1620, 2010 ed., Chapter 8, Paragraph 8.1: *The pre-incident plan shall identify and document any special hazards recognized by the authority having jurisdiction that present extraordinary life safety challenges, operations challenges, or other challenges to emergency responders.*

NFPA 1620, 2010 ed., Annex, Paragraph A.4.4.1: *The pre-incident plan should be the foundation for making decisions during an emergency situation and provide important data that will assist the incident commander in developing appropriate strategies and tactics for managing the incident.*

NFPA 1620, 2010 ed., Annex, Paragraph A.4.4.2: *The pre-incident plan should help responding personnel identify critical factors that will affect the ultimate outcome of the incident, including personnel safety.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 50:*** (Regarding which structures should be pre-planned) *If there is a high hazard (including firefighter safety issues), a particularly difficult extinguishment problem, or high-value property, then there is a need to prepare a pre-incident plan.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 285:*** *Industrial Occupancies: Recognizing hazards and equipment limitations is paramount during an industrial fire. In the large industrial building or complex, pre-incident planning is critical to firefighter safety and efficient operations.*

Finding 3: Incident Management

The West Fertilizer Company incident clearly demonstrates the critical importance of establishing a comprehensive incident management system (IMS) to provide command, control, and coordination of emergency operations. Fire department officers failed to provide supervision of subordinate members, implement an IMS, establish an incident command post, and properly identify an incident commander (IC). The absence of command and control and the failure to create and communicate an incident action plan resulted in an uncoordinated and unmanaged fire ground operation.

Recommendation:

An IMS should be fully incorporated into the basic operational processes of all fire departments and routinely applied to every emergency incident and training exercise to provide the appropriate structure for conducting operations. An easily visible, stationary command post should be established at the beginning of an incident and be staffed by a well-informed commander. Having an established command post will give incoming units a reporting position and lend itself to better organization. The commander should use every means available to gather information about the conditions on the fire ground before tactical decisions are made. The application of IMS is critically important in situations that involve complex problems and exceptionally hazardous circumstances. Key concepts of incident management that must be fully integrated into the operations of fire departments include:

(1) Establish an IC, performing a standard set of functions within a well-defined system.
(2) Determine an overall strategy for the incident, based upon an appropriate size-up.
(3) Delegate authority and responsibility to subordinate officers with predefined roles within a standard structure.
(4) Ensure that the IC, whether individually or, as a unified command, has overall authority and responsibility for management of all activities at an incident.
(5) Establish a fixed command post in a safe location that allows the IC to view the overall incident scene.
(6) Ensure that the IC conducts an initial size-up and risk assessment of the incident scene before beginning firefighting operations.
(7) The IC should re-evaluate the situation continuously, based on observation, reconnaissance, information gathering, effective communications and situational awareness.

References:

NFPA 1021, Fire Officer Professional Qualifications, 4.6: Emergency Service Delivery. *This duty involves supervising emergency operations, conducting pre-incident planning, and deploying assigned resources in accordance with local emergency plans and according to the following performance requirements:*

4.6.1 *– Develop an initial action plan, given the size-up information for the incident …*

4.6.1(A) – Requisite Knowledge. *Elements of a size-up, standard operating procedures for emergency operations, and fire behavior.*

4.6.1(B) – Requisite Skills. *The ability to analyze emergency scene conditions; to activate the local emergency plan, including localized evacuation procedures …*

4.6.2 *– Implement an action plan at an emergency operation, given assigned resources, type of incident, and a preliminary plan …*

4.6.2(A) *– Requisite Knowledge. Standard operating procedures, resources available for the mitigation of fire and other emergency incidents, an incident management system, scene safety, and a personnel accountability system.*

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4.6.2(B) – Requisite Skills. *The ability to implement an incident management system, to communicate orally, to manage scene safety, and to supervise and account for assigned personnel under emergency conditions.*

NFPA 1026, Incident Management Personnel Professional Qualifications.

4.1.1.1 – *General Knowledge Requirements. The importance of command presence to an IC … knowledge of the Incident Command System (ICS) …*

4.1.1.2 – *Prioritizing tasks so as to accomplish the most critical first, making effective decisions in an environment with a large number of unknowns … anticipating hazards, taking action in a proactive manner to ensure responder safety and health …*

4.2.1 – *Assume initial command of an incident … so that the incident conditions are accurately assessed, the safety of all responders is ensured, a detailed size-up report is transmitted, an appropriate initial Incident Action Plan (IAP) is developed … and the person assuming command and his or her location is identified.*

NFPA 1500 as referenced by ***Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA*** (Kalene and Sanders), ***pg. 107:*** *An incident management system must be used at all scenes. The IC maintains command and control of all operating forces within a common strategy based on situational analysis. The situational analysis must be ongoing with changes in strategy consistent with the changing situation. Inexperienced members must be directly supervised by more experienced members.*

NFPA 1561, Chapter 5, Section 5.3.3: *The incident management system shall clearly identify who is in overall command at the scene for the duration of the incident.*

NFPA 1561, 5.3.7.1: *Following the initial stages of the incident, the incident commander shall establish a stationary command post. A stationary command post should be established to plan, organize, and account for all aspects of the operation.*

NFPA 1561, 5.3.7.2: *In establishing a command post, the Incident Commander shall ensure the following:*

(1) The command post is located in or tied to a vehicle to establish presence and visibility.

(2) The command post includes radio capability to monitor and communicate with the assigned tactical, command, and designated emergency traffic channels for that incident.

(3) The location of the command post is communicated to the communications center.

(4) The Incident Commander, or his or her designee, is present at the command post.

(5) The command post shall be located in the cold zone of an incident.

NFPA 1561, 5.3.8: *The Incident Commander shall continually conduct a thorough situation evaluation.*

NFPA 1561, 5.3.17: *The Incident Commander shall evaluate the risk to responders with respect to purpose and potential results of their actions in each situation.*

NFPA 1561, 5.3.18: *In situations where the risk to emergency service responders is excessive, activities shall be limited to defensive operations.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 58:*** *The effectiveness of the operation must constantly be evaluated. The IC continually evaluates the safety and effectiveness of the standard operation and determines whether a nonstandard attack would be more effective.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 58:*** (Organization and coordination); *the first arriving company begins the process by organizing the initial attack and communicating orders to incoming units.*

Fire Command, The Essentials of Local IMS (Brunacini), ***Chapter 1, The Command Post:*** *… the stand-command position for the incident commander is a stationary one, located outside the hazard zone … It should be situated in a standard and predictable location that affords the IC a good view of the scene and the surrounding area. To a major extent, command effectiveness (or ineffectiveness) is directly connected to regular command positioning, and the entire command system revolving around the rapid establishment of a stationary, remote IC operating in a stand command post.*

Command and Control of Fires and Emergencies (Dunn), Fire Engineering Books Publishing, ***page 63:*** Command Post. *Set up a command post at every fire, and direct the operation from this location.*

Additional references used in formulating the recommendations in this finding:

IFSTA (2008) Essentials of Fire Fighting, (5th Edition), Chapter 1, page 39, Fire Protection Publications, Oklahoma State University.

U.S. Department of Homeland Security - Federal Emergency Management Agency Incident Command Systems; http://www.fema.gov/emergency/nims/ICSpopup.htm#item5.

Finding 4: Strategy and Tactics

4A. The fire department did not approach this fire as a commercial structure with hazardous materials, but rather initiated residential structural firefighting practices, with which they were familiar.

4B. Fire department officers did not determine an appropriate firefighting strategy (e.g., offensive, defensive, including evacuation) or coordinated tactical plan, which are key factors in controlling and mitigating fire incidents and protecting firefighters.

4C. There was no appearance of an appropriate firefighting strategy based on

(1) an accurate size-up of the incident.

(2) a realistic evaluation of the available resources.

(3) the capabilities of fire crews responding to an operation of this scale.

(4) the application of risk management principles, such as those found in the *International Association of Fire Chiefs* ***Rules of Engagement***:

(a) Determine the occupant survival profile.

(b) Do not risk your life (or your firefighters) for lives or property that cannot be saved.

(c) Extend limited risk to protect savable property.

(d) Extend vigilant and measured risk to protect and rescue savable lives.

(e) Abandon your position and retreat before deteriorating conditions can harm you.

(f) If you do not have the resources to safely support and protect firefighters, seriously consider a defensive strategy.

Recommendation:

A strategic incident action plan (IAP) for all emergency operations should be implemented by the IC through a coordinated application of appropriate emergency scene tactics for the presented dangers (e.g., high-risk, commercial structure, hazardous material, fire, etc.). The incident commander should determine and coordinate the necessary resources to execute the action plan safely and effectively, based initially on an effective and accurate scene size-up and through a definitive strategy and tactic to mitigate dangers while keeping firefighters as safe as possible. The effectiveness of an incident action plan must be closely monitored and continuously re-evaluated to ensure that it is meeting the IC's expectations. If the attack is not effective and/or conditions change in a manner that shifts the risk management balance, the IC must re-evaluate the strategy, adjust the tactics and, if necessary, change the incident action plan, up to and including, evacuation of the incident scene.

References:

NFPA 1021, Fire Officer Professional Qualifications

4.6.1 *Develop an initial action plan, given the size-up information for the incident …*

4.6.1(A) *Requisite Knowledge. Elements of a size-up, standard operating procedures for emergency operations, and fire behavior.*

4.6.1(B) *Requisite Knowledge. The ability to analyze emergency scene conditions; to activate the local emergency plan, including localized evacuation procedures …*

4.6.2 *Requisite Knowledge. Implement an action plan at emergency operations, given assigned resources, type of incident, and a preliminary plan …*

4.6.2(A) *Requisite Knowledge. Standard operating procedures, resources available for the mitigation of fire and other emergency incidents, an incident management system, scene safety, and a personnel accountability system.*

4.6.2(B) *Requisite Skills. The ability to implement an incident management system, to communicate orally, to manage scene safety, and to supervise and account for assigned personnel under emergency conditions.*

NFPA 1026, Incident Management Personnel Professional Qualifications

4.2.2 (A) *Requisite Knowledge: Applicable strategies and tactics for various types of incidents, safety factors and considerations for incident operations, and variables and conditions that affect incident outcomes.*

4.2.2(B) *Requisite Knowledge: Performing a size-up and interpreting incident information for the purpose of verifying the effectiveness, applicability, and safety of the size-up.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 53:*** *Once on scene, the IC will add to what is known through personal observation, communication with fire companies and building personnel, and reconnaissance. Once the on-scene information is processed, the IC must quickly evaluate the action that is taking place and the conditions of the building.*

NFPA 1143, Annex, Paragraph A 5.4.2: *The safety and welfare of personnel are the first and foremost considerations in all incident operations and decisions.*

Texas Commission on Fire Protection Standards Manual, Chapter 435, Section 435.15, Part b, Paragraphs 1 and 2:

(1) specify an adequate number of personnel to safely conduct emergency scene operations;

(2) limit operations to those that can be safely performed by personnel at the scene …

Fireground Support Operations 1st Edition, IFSTA, Chapter 10, Fundamentals of Firefighting Skills, NFPA/ IAFC, 2004, Chapter 2: *Fire departments should require crews to perform a complete scene size-up before beginning operations. A thorough size-up will provide a good base for deciding tactics and operations. It provides the IC and on-scene personnel with a general understanding of fire conditions, building construction, and other special considerations.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 217:*** *Attacking a fire with anything less than a water supply from a source of water that is capable of supplying flow requirements over an extended period of time is a gamble. Attack pumper tactics (operating with water from the attack pumper) work well in many situations, especially fighting a small dwelling. However, relying solely on water from the apparatus water tank can be dangerous.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 284:*** *Storage Occupancies: The risk of fast moving fire or explosion may be high within the storage occupancy … Fighting a fire in a large commercial building is more challenging tactically than attacking a fire inside a small residential building.*

Structural Firefighting Strategies and Tactics, 2nd Edition, NFPA (Kalene and Sanders), ***pg. 285:*** *Industrial Occupancies: Recognizing hazards and equipment limitations is paramount during an industrial fire. In the large industrial building or complex, pre-incident planning is critical to firefighter safety and efficient operations. The number of hazards and the potential for harm dictate that special tactics be developed for each large manufacturing storage property within a jurisdiction.*

Finding 5: Firefighter Safety and Accountability

Firefighting operations were not conducted in a manner that incorporated national and industry recognized safety standards and practices.

5A. The safety and welfare of fire department personnel were not the first and foremost considerations in incident operations and decisions.

5B. An incident safety officer was not appointed.

5C. A firefighter accountability system was not utilized.

5D. Personnel operating within the IDLH environment did not utilize full appropriate PPE including SCBA.

5E. Nationally recognized firefighter risk management principles were not applied.

Recommendation:

(1) The safety and welfare of fire department personnel should be the first and foremost considerations in incident operations and decisions.

(2) Fire departments should designate a safety officer at all working incidents. Fire departments should ensure that the incident safety officer (ISO) position, independent from the incident commander, is appointed and effectively utilized at every structure fire, meeting the requirements within ***NFPA 1521, Standard for Fire Department Safety Officer***. The incident safety officer or assistant safety officer(s) shall have the authority to immediately correct situations that create an imminent hazard to personnel.

(3) All firefighters must be empowered to stop unsafe practices.

(4) Fire departments must implement and utilize an accountability system to track all members working within the IDLH area.

(5) Fire departments, through the assigned IC, must maintain accountability for all personnel operating on the emergency scene.

(6) Fire departments must ensure that all firefighters wear incident appropriate personal protective equipment (PPE), including SCBA appropriate for the assigned task while participating in fire suppression activities.

(7) Risk management principles with regards to safety rules of engagement shall be applied to fire suppression and emergency scene activities.

References:

Finding 5A

NFPA 1143, Annex Section 5.4.2: *The safety and welfare of personnel are the first and foremost considerations in all incident operations and decisions.*

NFPA 1561, 2008 ed., Chapter 5, Paragraph 5.10.1.5: *Supervisory personnel shall ensure that the safety and health of all responders is the primary consideration.*

Finding 5B

NFPA 1521, 2008 ed., Chapter 3, Paragraph 3.3.44.2 defines the Incident Safety Officer (ISO) as: *A member of the command staff responsible for monitoring and assessing safety hazards or unsafe situations and for developing measures for ensuring personnel safety.*

NFPA 1561, 2008 ed., Chapter 5, Paragraph 5.9.6.6.3 : The major responsibilities of the safety officer, which shall apply to any incident, are as follows:

(4) Exercise emergency authority to stop and prevent unsafe acts.

Finding 5C

Texas Commission on Fire Protection Standards Manual, Chapter 435, Section 435.13, Part b, Paragraph 3 & 4, and Part d: *The accountability system shall*

(3) require that all fire protection personnel operating at an emergency incident to actively participate in the personnel accountability system; and,

(4) require that the incident commander be responsible for the overall personnel accountability system for the incident; (d) the personnel accountability system shall meet the minimum standards required by the NFPA 1561, Standard on Fire Department Incident Management System.

NFPA 1561, Chapter 4, Resource Accountability

4.5.1: *The Emergency Services Organization (ESO) shall develop and routinely use a system to maintain accountability for all resources assigned to the incident with special emphasis on the accountability of personnel.*

This system shall also provide a process for the rapid accounting of all personnel at the incident scene. All supervisors shall maintain a constant awareness of the position and function of all personnel assigned to operate under their supervision. This awareness shall serve as the basic means of accountability that shall be required for operational safety.

Finding 5D

NFPA 1500, 7.1.2: *Protective clothing and protective equipment shall be used whenever the member is exposed or potentially exposed to the hazards for which it is provided.*

IFSTA, Essentials of Fire Fighting, (5th Edition), Ch.5, pg.167: *When operating at any emergency scene, firefighters must wear protective clothing and equipment suitable to that incident.*

Finding 5E

NFPA 1561, 2008 ed., Chapter 4

4.2.1: *The incident commander shall integrate risk management into the regular functions of incident command.*

4.2.2: *The risk management plan shall meet the requirements of Chapter 4 of NFPA 1500.*

NFPA 1500, 2013 ed., Chapter 8

8.3.1**The incident commander shall integrate risk management into the regular functions of incident command.*

8.3.2**The concept of risk management shall be utilized on the basis of the following principles:*

(1) Activities that present a significant risk to the safety of members shall be limited to situations where there is a potential to save endangered lives.

(2) Activities that are routinely employed to protect property shall be recognized as inherent risks to the safety of members, and actions shall be taken to reduce or avoid these risks.

(3) No risk to the safety of members shall be acceptable when there is no possibility to save lives or property.

(4) In situations where the risk to fire department members is excessive, activities shall be limited to defensive operations.

Additional references used in formulating the recommendations in this finding:

Everyone Goes Home, 16 Firefighter Life Safety Initiatives. The full 16 Life Safety Initiatives can be found at http://www.lifesafetyinitiatives.com/initiatives.html.

Participate in the "Courage to be Safe" (CTBS) program that emphasizes the message "Everyone Goes Home." Information on the CTBS program is available online at http://www.everyonegoeshome.com.

Texas Administrative Code Chapter 435.25, www.tcfp.texas.gov

"(a) In an effort to improve firefighter safety in the State of Texas, all regulated entities will ensure that the National Fallen Firefighters Foundation's "Courage to be Safe So Everyone Goes Home" program be completed as part of the continuing education required for certified fire protection personnel by December 1, 2015. Individuals will be credited with four hours of continuing education credit for completing this program.

(b) All regulated fire protection personnel must complete the National Fallen Firefighters Foundation's "Courage to be Safe So Everyone Goes Home" program prior to December 1, 2015."

"Effective January 1st, 2012, the SFFMA Certification Program for volunteer departments requires completion of the ***Everyone Goes Home*** *- "Courage to be Safe" course for any new applications submitted after January 1, 2012."*
www.sffma.org

NFPA 1720, 4.5.1.3 : The incident commander shall ensure that a personnel accountability system is immediately utilized to rapidly account for all personnel at the incident scene.

Finding 6: Training

The State of Texas has not adopted minimum training standards for volunteer fire departments; however, all fire department members must be properly trained and qualified to perform their assigned duties. Members who are authorized to work in high-level assignments (rank) must be trained and evaluated in performing those duties. All members must be periodically re-evaluated to ensure that they are capable of performing their assigned duties safely and effectively.

Recommendation:

(1) Fire departments must establish realistic training and educational requirements for all positions and ranks and a promotional process that ensures that ranking members demonstrate a progressive knowledge, skill, and ability to perform their assigned duties and responsibilities according to their position in the organization.

(2) Fire department companies should be trained and periodically evaluated in performing a range of standard company functions within a system of standard operating procedures.

(3) Fire department members must be trained to recognize hazardous conditions and situations, such as construction types and unusual and hazardous fire loads, and react appropriately.

(4) Fire department company and command officers should be trained at an increasing level of firefighting strategy and tactics, including the application of operational risk management principles.

(5) Simulation exercises should be conducted to provide experience in managing unusual, complex, and challenging situations.

(6) Ensure that all firefighters and line officers receive fundamental and annual refresher training according to ***NFPA 1001*** and ***NFPA 1021***.

(7) Implement joint training on response protocols with mutual aid departments.

(8) Fire departments should develop standard operating guidelines and conduct appropriate training involving those critical findings as noted in this document and specific to incident command, strategy and tactics, and firefighter safety as listed in the reference sections of each respective area.

References:

NFPA 1500 5.1.2: *The fire department shall provide training, education, and professional development for all department members commensurate with the duties and functions that they are expected to perform.*

NFPA 1500 5.1.6: *The fire department shall provide all members with training and education on the fire department's written procedures.*

Finding 7: Fire Prevention, Code Enforcement, and Risk Mitigation

The fire department had no authority or regulatory governance over material storage or building (fire) preventative measures in this incident.

The following recommendations are imperative to list for fire department awareness purposes and the future safety of firefighters.

Recommendation:

(1) A properly installed and maintained fire sprinkler system might have controlled the fire. Measures that mandate or provide incentives to install automatic sprinklers or support alternative fire protection measures should be adopted as public policy.

(2) Mitigation programs to reduce or eliminate excessive risk levels should be encouraged and supported.

(3) It is government's responsibility to ensure that adopted fire and safety codes are adequately enforced through systematic inspections.

(4) Fire departments should be trained to recognize fire hazards and code violations and should have a specific responsibility to take appropriate corrective measures.

Reference:

NFPA 400, Hazardous Materials Code, 2013 Edition, Chapter 11: *The requirements of this chapter shall apply to the storage, use, and handling of ammonium nitrate when the amount of solid or liquid ammonium nitrate exceeds the MAQ as set forth in Chapter 5.*

Finding 8: Adopt and Enforce a Fire Prevention Code

There was no fire prevention code adopted by the local jurisdiction. Currently, the regulatory landscape for fire prevention is inconsistent from jurisdiction to jurisdiction. In municipalities where there is no adopted fire prevention code, one should be adopted. Regarding counties, Texas Local Government Code 233.061 only allows counties with a population of 250,000 or more, or those counties adjacent to a county with a 250,000 or more population, to adopt a fire code.

Recommendation:

The local jurisdictions should adopt a fire prevention code. The Texas Legislature should consider allowing all counties to adopt a fire code.

There are two nationally accepted model fire codes in the US: the ***International Fire Code (IFC)*** and ***NFPA 1, Fire Code.*** Both adequately address egress as well and either is acceptable.

Regardless of which model fire prevention code is used, particular emphasis should be placed on the administrative requirements of Chapter 1 of either document. Chapter 1 describes the accepted minimum requirements for effective administration and enforcement of a fire prevention code.

Adopting a fire prevention code resolves the majority of regulatory applicability questions for fire prevention. Both model fire codes reference lower tier codes and standards (many of which are NFPA documents) by edition, so there are never questions about which codes and/or standards and editions thereof are applicable.

References:

2012 IFC, Preface, p. vii: **Effective Use of the International Fire Code**

The ***International Fire Code (IFC)*** addresses fire prevention, fire protection, life safety and safe storage and use of hazardous materials in new and existing buildings, facilities and processes. The ***IFC*** provides a total approach of controlling hazards in all buildings and sites, regardless of the hazard being indoors or outdoors.

The ***IFC*** is a design document. For example, before one constructs a building, the site must be provided with an adequate water supply for fire-fighting operations and a means of building access for emergency responders in the event of a medical emergency, fire or natural or technological disaster. Depending on the building's occupancy and uses, the ***IFC*** regulates the various hazards that may be housed within the building, including refrigeration systems, application of flammable finishes, fueling of motor vehicles, high-piled combustible storage and the storage and use of hazardous materials. The ***IFC*** sets forth minimum requirements for these and other hazards and contains requirements for maintaining the life safety of building occupants, the protection of emergency responders, and to limit the damage to a building and its contents as the result of a fire, explosion or unauthorized hazardous material discharge.

2012 NFPA 1, Fire Code

1.2* Purpose. *The purpose of this Code is to prescribe minimum requirements necessary to establish a reasonable level of fire and life safety and property protection from the hazards created by fire, explosion, and dangerous conditions.*

1.3 Application.

1.3.1 *This Code shall apply to both new and existing conditions.*

Finding 9: Establish a Consistent Hazardous Materials Program per Fire Code Requirements

There was no adopted hazardous materials program adopted by the local jurisdiction.

Recommendation:

Above all, the incident at West was a hazardous materials incident. While it occurred in an industrial setting, simply applying common industrial firefighting tactics would not have been successful. Industrial firefighting tactics can be successful in occupancies with high-challenge commodities (such as a warehouse with high-rack storage, tire storage, most industrial processes, etc.) but to be successful at a facility such as West Fertilizer, such an approach must be dovetailed with an effective hazardous materials program. A program to address hazardous materials is integral to and required by the model fire prevention codes (see Finding 7) and might have prevented the explosion and fatalities at West Fertilizer.

Hazardous materials present unique fire hazards and have the capability to have a much broader impact on surrounding areas than fires that do not involve them. Ammonium nitrate can display both the accelerated burning characteristics of an oxidizer and the explosive characteristics of an unstable reactive. Both of these, as well as the characteristics of all other hazardous materials, are addressed by the hazardous material provisions of a fire prevention code. Effectively implementing such a program requires expertise and resources that may exceed those available in some jurisdictions. Regardless, the level of safety expected by the public requires such a program. In cases where expertise and capability to implement and enforce a hazardous material program does not exist within a jurisdiction, a qualified agency should develop and provide the service.

References:

IFC, 2012 edition, Chapters 1 and 50 with particular emphasis on §§105 *Permits*, 105.6.20 *Hazardous Materials*, and Chapter 50, *Hazardous Materials*.

Finding 10: Develop a Policy to Address Existing Structures

Existing structures that do not meet the requirements of ***NFPA 400, 2013 edition***, should be retroactively provided with several key features to assure adequate public and firefighter safety.

The following elements for existing ammonium nitrate buildings should be considered and have been *proposed* to the NFPA 400 Committee as revisions for the 2016 edition:

Require retrofit within a reasonable timeframe of the following protective measures:

(1) Install automatic sprinklers per ***NFPA 400, 2013 edition***.

(2) Install a fire alarm system for the entire building with a fire sprinkler system flow switch.

(3) Install a community evacuation siren automatically activated by the water flow switch for storage amounts greater than 1000 pounds.

(4) Develop a detailed Emergency Response Plan and Evacuation Plan for the area within 1 mile of the building.

Finding 11: Alcohol and substance abuse

The autopsy results of three of the responders to this incident indicated levels of alcohol and/or drugs. There was no evidence to suggest that the use of alcohol or drugs by these responders contributed to the explosion and the resulting fatalities.

Recommendation:

All fire and/or emergency service agencies/organizations should develop written policies and have procedures in place to restrict members from responding to emergency scenes while under the influence of alcohol or drugs.

Reference:

International Association of Fire Chiefs (IAFC) ***Guide to Model Policies & Procedures for Emergency Vehicle Safety, pg. 16, Alcohol and Substance Abuse.***

Fire department members are not permitted to be on duty, to respond to emergency incidents, to drive or operate fire department vehicles, nor to perform any other duty-related functions while under the influence of alcohol or drugs. Fire department members shall not perform any duty-related functions for a minimum of eight hours following the consumption of any alcoholic beverages. A longer period waiting period may be required to ensure that the individual is free of impairment. A blood alcohol concentration of 0.02 percent or higher, while on duty, shall create the pre-sumption that the member is under the influence of alcohol.

Appendix 1: The HMEx Assistant Chemical Classification

The HMEx Assistant
Chemical Classification

C.A.S. No.	Concentration	State	RTECS
6484-52-2	100%	Solid	BR9050000

Boiling Point	210DEC	LD 50	2217R	Molecular Weight	80.00
Melting Point	170 C	LC 50	ND	Specific Gravity	1.73
Flash Point	NA	LFL/LEL	NA	Vapor Density	NA
Autoignition Temp.	NA	UFL/UEL	NA	Vapor Pressure	ND

IUPAC Name

ammonium nitrate

Synonyms

ammonium nitrate, dynamite grade
nitric acid, ammonium salt
Norway saltpeter
nitram

Notes

Specific Gravity/Density at 25 degrees Centigrade. Undergoes detonation if heated under confinement, or if subjected to strong shocks. Contact with easily oxidizable, organic, or other combustible materials may result in ignition, violent combustion or explosion. Ammonium nitrate of any grade including fertilizer, when contaminated with more than 0.2% cobmustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance, i.e., oil, charcoal, or other organic substances and flammable liquids, is considered to be a Division 1.1D explosive by the Department of Transportation (DOT).

IFC Physical Hazards

Oxidizer Solid/Liquid Class 3
Unstable Reactive Class 3D

IFC Health Hazards

Irritant *

** Hazard property not regulated by the IFC.*

DOT

Shipping Name
Ammonium nitrate, with not more than 0.2 percent combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance.

Labels Required
OXIDIZER

Hazard Class or Division 5.1
ID # UN1942
Packing Group III

SARA

The material identified is not specifically listed either as a SARA Title III, OSHA Process Safety Management, CERCLA or Clean Air Act chemical; therefore, threshold quantity limits have not been established. However, any chemical requiring an MSDS may require reporting under the requirements of SARA Title III Section 312.

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Appendix 2: Best Practices for the Storage of Ammonium Nitrate

References Related to *Best Practices*: Storage of Ammonium Nitrate

Please check with your local jurisdiction having authority to determine whether there is a local fire code or other regulatory code that must be utilized related to storage of ammonium nitrate. Depending on the regulations adopted, the best practices listed below may be mandatory.

Additional information is available on the State Fire Marshal's Office website at http://www.tdi.texas.gov/fire/fman.html.

On August 30, 2013, the United States Occupational Safety and Health Administration; Bureau of Alcohol, Tobacco, Firearms and Explosives; and the U. S. Environmental Protection Agency provided the following:

Chemical Advisory: Safe Storage, Handling, and Management of Ammonium Nitrate

http://www.epa.gov/osweroe1/docs/chem/AN_advisory.pdf

Occupational Safety and Health Administration (OSHA)

OSHA Standard 1910.109(i)(4) also defines additional requirements for storage of ammonium nitrate. The following are some, but not all the requirements:

1910.109(i)(5)(i)(a): "Ammonium nitrate shall be in a separate building or shall be separated by approved type firewalls of not less than 1-hour fire-resistance rating from storage of organic chemicals, acids, or other corrosive materials … "

1910.109(i)(5)(i)(b): "In lieu of separation walls, ammonium nitrate may be separated from the materials referred to in paragraph (a) of this section by a space of at least 30 feet."

1910.109(i)(6)(i): "Electrical installations shall conform to the requirements of subpart S of this part, for ordinary locations. They shall be designed to minimize damage from corrosion."

1910.109(i)(7)(ii)(a): "Water supplies and fire hydrants shall be available in accordance with recognized good practices."

The U.S. Senate Committee on Environment and Public Works held a hearing on June 27, 2013, in Washington, D.C., and various experts from the Chemical Safety Board, Department of Homeland Security, Texas A&M University,

and others all agreed with Chairperson Boxer that fire must be prevented from reaching bulk storage of ammonium nitrate. Some recommendations included:

- Storage of ammonium nitrate in non-combustible storage facilities or at least have a one-hour fire barrier separating a storage bin of ammonium nitrate from other adjacent products.
- Fire sprinkler system suitable for a corrosive atmosphere.
- Third-party inspection of these facilities should be in place (e.g., insurance companies insuring these facilities, safety institutes, etc.)

Note: This is not an all-inclusive list of best practices related to storage of ammonium nitrate, but is provided to provide highlights from three resources to facilitate further research by the property manager and/or owner.