Shackelford

John C. Shackelford
3333 Lee Parkway – Tenth Floor
Dallas, Texas 75219
214.780.1414
jshack@shackelfordlaw.net

March 31, 2015

Via Federal Express
Mr. Tim Irvine
Executive Director
Texas Department of Housing
& Community Affairs
221 East 11th Street
Austin, Texas 78701-2410

Re: Challenge; Application No. 15159; Abbington Commons of Whitewright;
Our File No. 13320.2

Dear Mr. Irvine:

This law firm represents the applicant for the project known as the Courtyard Apartments located at NEQ Church Street and Interstate Highway 35, Sanger, Texas, having Application No. 15029, and I have been requested by Jorge Ramirez, to write you for the purpose of challenging the Undesirable Site Features located near the proposed Abbington Commons of Whitewright ("Abbington Commons").

This challenge is made pursuant to Section 11.10 of the 2015 Qualification Action Plan ("QAP"). Enclosed herewith is the required fee in the amount of $500.00 issued to and made payable to the order of the Texas Department of Housing and Community Affairs.

The basis for the challenge is pursuant to Section 11.10(5) of the QAP which pertains to undesirable site features described in Sections 10.101(a)(3)(D) and (J). Specifically, located within 2 miles of the proposed site for Abbington Commons is an ammonium nitrate ("AN") storage facility which constitutes a potentially hazardous use and potentially exposes residents to an environmental factor that may adversely affect the health and safety of the residents.

Located within 960feet of the Abbington Commons site is the El Dorado Chemical Company ("El Dorado") located at 1102 South Bond Street. El Dorado is a chemical company in the business of, among other things, storing AN, which is commonly used in agriculture as a high-nitrogen fertilizer. As set forth in the attached report prepared by SCS Engineers dated March 27, 2015 (the "Report"), a copy of which is attached hereto as Exhibit A and incorporated herein by reference for all purposes, El Dorado stores, within 960 feet from the Abbington Commons site, a minimum of 500,000 pounds of AN, which is equivalent to approximately 165,000 pounds of

TNT. This is the approximate minimum amount of AN stored on site on a daily basis based upon an interview conducted by SCS Engineers with Jake Reynolds, Chief of the Whitewight Volunteer Fire Department. Mr. Reynolds further stated that the El Dorado location has the capacity to store up to 800 tons or 1.6 million pounds of AN and that the daily average amount of AN stored at the El Dorado facility is in the range of 500,000 to 999,999 pounds.

AN is a hazardous chemical under the OSHA Hazard Communication Standard and facilities such as El Dorado that store AN are required by law to submit information regarding AN to their State Emergency Response Commission, Local Emergency Planning Committee and Local Fire Department.

As you know, AN is at risk for explosion which is why I think that the huge volume of AN stored at El Dorado within 960 feet of the Abbington Commons site constitutes an undesirable site feature under Sections 10.101(3)(D) and (J). Furthermore, based upon the testing which is set forth in the Report, SCS Engineers determined that the Abbington Common site is located within a blast zone radius should a catastrophe occur which equates to an overpressure of between 3 and 5 psi. The significance of this fact is that the HUD Acceptable Separation Distance Guidebook, a copy of which is attached hereto as <u>Exhibit B</u> ("HUD Guidebook"), states on Page 15 that "the perimeter standard of 0.5 psi is the maximum allowable pressure that can be measured at a distance from an explosive hazard when selecting a site for HUD-assisted housing and occupants."

Although it is true that the applicant for Abbington Commons is not required under Section 10.101(a)(4) of the QAP to obtain an ESA that satisfies the ASTM Requirements and the other items stated in Section 10.305(b) of the QAP, I disagree with applicant's statement, "there are no known undesirable site or neighborhood characteristics associated with the Development Site." It is quite obvious from the Report that El Dorado contains such a large volume of AN on a daily basis that should a tragedy occur and something causes the AN stored at El Dorado to explode, the Abbington Commons site clearly would be severely impacted due to it being within the blast zone radius that it is and which violates the HUD Guidebook. The potential for another tragedy similar to what occurred in West, Texas should not be permitted.

It is for these reasons that this challenge is made to Abbington Commons and I look forward to your review and determination of whether the Abbington Commons site is burdened with undesirable site features in accordance with Sections 10.101(3)(D) and (J).

Very truly yours,

John Shackelford/tlw

John C. Shackelford

JCS:tlw
Enclosures

cc: Cameron Dorsey (*via email and Fedex*)
Jean Latsha (*via email and Fedex*)
Barbara Deane, Esq. (*via email and Fedex*)
Jorge Ramirez (*via email and Fedex*)
Mohannad H. Mohanna (*via email and Fedex*)

L:\13320\2\Irvine Letter.docx

Environmental Consultants
and Contractors

3900 Kilroy Airport Way
Suite 100
Long Beach, CA 90806-6816

562 426-9544
FAX 562 427-0805
www.scsengineers.com

SCS ENGINEERS

March 27, 2015
Job No. 01215081.00

Via Email (Moe.mohanna@housingpartners.com)

Mr. Jorge Ramirez
Church Street Housing, L.P.
Church Street Housing GP, LLC, its General Partner
c/o Balcones Urban, LLC, its Managing Member
8117 Preston Road, Ste. 300
Dallas, TX 75255

Subject: **Evaluation of a Potential Multi-Family Housing Property located at South Bond Street and Echols Lane with Respect to the Storage of Ammonium Nitrate at a nearby facility in Whitewright, Texas**

Dear Mr. Ramirez:

This letter summarizes our evaluation of the blast pressure that could result from an accidental explosion of ammonium nitrate (AN) stored at the El Dorado Chemical Company (El Dorado) located at 1102 South Bond Street. The purpose of our evaluation was to determine if the potential multi-family (MF) housing site would be affected by such an explosion, as required by Texas Department of Housing & Community Affairs (TDHCA) Multifamily Housing Rental Programs and U.S. Department of Housing and Urban Development (HUD) guidelines.

BACKGROUND

AN is commonly used in agriculture as a high-nitrogen fertilizer. In response to several catastrophic explosions at facilities storing AN in the past, including the April 2013 fire that resulted in detonation of AN fertilizer that killed 15 people in West Texas, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) issued the *Chemical Advisory: Safe Storage, Handling, and Management of Ammonium Nitrate* (August 2013) as part of an ongoing federal effort to improve chemical risk management, to advance safety, and to protect human health and the environment. The Advisory indicates AN may explode when exposed to strong shock or when subjected to high temperatures in confinement and lists several key lessons learned as a result of numerous accidents and studies involving AN including:

- AN will self-compress/self-confine under some conditions, becoming much more likely to explode.
- AN is at risk for explosion when stored near other material that can add fuel to the AN – such as grain, sugar, seeds, sawdust, and most especially petroleum fuels such as diesel.

EXHIBIT
A
exhibitsticker.com

- AN is a powerful oxidizer and a rich source of nitrate, which provides energy to an explosion, thus the presence of fuel and/or heat (and especially both) near AN is a very high hazard situation.

According to the Advisory, "AN is a hazardous chemical under the OSHA Hazard Communication Standard. Therefore, facilities that handle and store AN are required by law to submit information regarding chemical hazards (including AN) to their State or Tribal Emergency Response Commission, Local Emergency Planning Committee, and local fire department including 1) Safety Data Sheets providing the chemical's hazard information and emergency response guidelines and 2) a hazardous chemical inventory form that provides the quantity, storage types and locations of the AN at their facility."

General State and Local Agencies Information

According to the Texas Department of Insurance (TDI) website (http://www.tdi.texas.gov/fire/fman.html), the State Fire Marshal's Office conducted voluntary inspections of facilities storing bulk amounts of AN around the state in response to the Homeland Security and Public Safety Committee's recommendations following the 2013 West Texas disaster. The TDI website has a database of facilities storing more than 10,000 pounds (the limit that triggers requirement to report) of AN, searched by zip code (https://apps.tdi.state.tx.us/ammoniumnitrate/StartAction.do). The database identifies one facility, determined to be the El Dorado facility, located in the zip code of 75491 for Whitewright, Texas.

EVALUATION OF AMMONIUM NITRATE STORAGE FACILITY

State and Local Agency Interviews

The contact listed in the TDI database for the El Dorado facility was identified as the Whitewright Volunteer Fire Department (VFD), however, an attempt to contact the VFD found the associated number has been disconnected. SCS contacted the State Fire Marshal's office for further information, and we sent a request dated March 22, 2015, to the Texas Department of State Health Services for records associated with the Tier II Chemical Reporting Program for the El Dorado Chemical facility and any other facilities within zip code 75491 for Whitewright, Texas. As of the date of this letter, no response to the records request has been received.

Mr. Roger Young of the State Fire Marshal office, returned a phone call requesting additional information; however he said he was unable to give any specific information on the El Dorado facility per guidance from the Texas Attorney General. Mr. Young did provide the current status and contact information for the local VFD, and SCS conducted an interview with Mr. Jake Reynolds, Chief of the Whitewright VFD, on March 23, 2015. Mr. Reynolds confirmed that the El Dorado facility is required to report under the Tier II program. He also indicated that Helena Chemical, located adjacent to El Dorado at 1110 South Bond Street, is not listed as a Tier II facility and thus is not required to report.

Mr. Reynolds described the location of El Dorado and storage of AN in a structure at the rear of the facility (east side), as depicted on **Figure 1**. According to Mr. Reynolds, the facility has the capacity to store up to 800 tons (1.6 million pounds), and stores the AN inside the building on the ground in piles. During the phone interview, Mr. Reynolds reviewed the 2014 and 2015 Tier II reports (dated February 24, 2014 and February 5, 2015, respectively). In the previous two years El Dorado reported the maximum daily amount of AN stored is in the range of one to ten million pounds and the daily average amount of AN stored at the facility is in the range of 500,000 to 999,999 pounds.

Facility Detail Report

We obtained and reviewed a Facility Report for El Dorado dated March 20, 2015, from Environmental Data Resources, Inc. as part of the evaluation. The report was requested in order to gain additional information on El Dorado and in an attempt to determine the volume of AN stored at the facility in case information from the VFD was not forthcoming.

According to the Facility Report El Dorado is listed on the EPA's Facility Index System (FINDS) database which contains facility information and 'pointers' to other sources that contain more detail. The FINDS database lists El Dorado as a Texas Commission on Environmental Quality (TCEQ) regulated facility for having a Solid Waste Registration number and a stormwater discharge (NPDES) permit.

El Dorado is listed under the "Other Database Records" for "groundwater contamination case description by the TCEQ" with a contaminant description of "nitrate, alpha BHC, dicamba, and arsenic". The date of earliest known contamination is reported as April 2010. The facility is listed as a Tier II reporter from 2005 through 2011 and reportedly has a chemical inventory of AN and ammonium phosphates with an average daily amount listed as 100,000 to 999,999 pounds; potassium chloride, potassium magnesium sulfate, ammonium phosphate dibasic, and calcium carbonate with an average daily amount of 10,000 to 99,999 pounds; manganese oxide/manganese sulfate with an average daily amount of 1,000 to 9,999 pounds; and monoammonium phosphate with an average daily amount of 100 to 999 pounds.

AMMONIUM NITRATE AS IT RELATES TO TDHCA AND HUD GUIDELINES

TDHCA 2015 Multifamily Rules

The TDHCA 2015 Uniform Multifamily Rules (Chapter 10, Subchapter D §10.305 (b) (8)) state that in addition to ASTM requirements the Environmental Site Assessment prepared for a proposed multi-family development site must "identify and assess the presence of oil, gas or chemical pipelines, processing facilities, storage facilities or other potentially hazardous explosive activities on-site or in the general area of the site that could potentially adversely impact the Development. Location of these items must be shown on a drawing or map in relation to the Development Site and all existing or future improvements. The drawing must depict any blast zones (in accordance with HUD guidelines) and include HUD blast zone calculations".

HUD Acceptable Separation Distance Guidebook

The following information was obtained from the HUD Acceptable Separation Distance (ASD) Guidebook:

- The ASD for a blast overpressure is based on the pressure wave exerted by detonation of a set mass quantity of TNT. This method of comparison, known as the "TNT equivalent" is used because the blast-overpressure produced by one pound of TNT is known.
- The parameter standard of **0.5 psi** is the maximum allowable pressure than can be measured at a distance from an explosive hazard when selecting a site for HUD-assisted housing and occupants.
- Blast overpressure can harm people or destroy buildings if this pressure is higher than 0.5 psi.

Ammonium Nitrate Explosion and TNT Equivalent Evaluation

FM Global (formerly Factory Mutual) is an insurance engineering entity that publishes guidance for use in evaluating different risks of loss. According to FM Global Property Loss Prevention Data Sheets (7-89) dated October 2013 for AN and mixed fertilizers containing AN (Section 2.2.1.2):

- Piles of less than 50 T (100,000 pounds) AN – minimal detonation hazard so no specific separation except to prevent fire propagation from adjoining areas.
- For piles exceeding 50 tons (100,000 pounds) of AN, detonation potential is assumed.
- An explosion efficiency factor of 33% for the detonation of AN compared to TNT.
- The explosion overpressure rings and damage effects should be calculated using the TNT equivalency method discussed in Data Sheet 7-0, Section 11.0.
- Sympathetic detonation of nearby piles of uncontaminated AN is not expected.

We used the approach described in the referenced FM Global Property Loss Prevention Data Sheets (7-0) dated April 2013 for Causes and Effects of Fire and Explosions (Section 11.0) to calculate overpressure rings that could be caused by an accidental explosion of 500,000 pounds of AN stored at El Dorado.

Blast waves are a major consequence of all explosions and move outward like the ripple of a stone dropped in a pool of water (spherical in shape). The amplitude (overpressure) and duration are related to the amount and how quickly the energy is released. The Hopkinson-Cranz Scaling

Law shows that the blast wave energy (overpressure and duration) decays at a rate proportional to the cube root of the distance from the explosion.

The common practice in predicting effects of explosion has been to translate the energy released into a TNT equivalent value. As suggested by FM Global, we assumed three pounds of AN would be equivalent to one pound of TNT. According to the February 2015 Tier II Report for El Dorado, the minimum daily amount of AN stored onsite is 500,000 pounds; this would be equivalent to about 165,000 pounds of TNT.

Calculation of Blast Zone Radius

Using the Scaling Law, it is possible to predict blast effects in terms of overpressure:

$$R_g = Z_g\,(W_e)^{1/3} \text{ or } Z_g = R_g/(W_e)^{1/3}$$

Where:

R_g = Radial distance from energy release epicenter (expressed in feet), at some overpressure
Z_g = Scaled ground distance (ft/lb$^{1/3}$) for a defined overpressure (Table 1 below)
W_e =TNT equivalent mass, expressed in pounds

Table 1. Scaled Ground Distance at Overpressures

Overpressure, P (psi)	*Scaled Ground Distance, Z (ft/lb$^{1/3}$)*
15	8
10	9.8
6	13
5	14.5
3	19.5
2	26
1	45

As indicated on **Figure 1**, the property line of the potential MF site is approximately 960 feet from the storage location of a minimum of 500,000 pounds of AN (equivalent to 165,000 pounds of TNT). Based on the above equation, this equates to a scaled ground distance of 18.21 ft/lb$^{1/3}$ (960/(165,000^$^{1/3}$)). Based on Table 1 above, a scaled ground distance of 17.5 ft/lb$^{1/3}$ (for the minimum amount of AN El Dorado is storing) equates to an overpressure between 3 and 5 psi, well above the maximum allowable pressure of 0.5 psi allowed by HUD and TDHCA.

The distances for a 1-, 2-, 3-, and 5-psi blast are depicted on **Figure 2** based on the following calculations using the scaled ground distances in Table 1:

- 1 psi blast radius = 45*(165,000^$^{1/3}$) = 2,468 feet
- 2 psi = 26*(165,000^$^{1/3}$) = 1,426 feet
- 3 psi = 19.5*(165,000^$^{1/3}$) = 1,070 feet

- 5 psi = $14.5*(165{,}000^{\wedge 1/3}) = 795$ feet

SUMMARY AND CONCLUSIONS

TDHCA follows HUD guidelines for evaluation of a site for multi-family development. Per the TDHCA 2015 Uniform Multifamily Rules, an evaluation of the ASD was conducted for the El Dorado Chemical Company which stores an average daily amount of AN between 500,000 to 999,999 pounds. We used 500,000 pounds of AN to calculate the blast radius for an accidental explosion at the El Dorado facility as it relates to a potential MF housing project approximately 960 feet away.

In conclusion, based on the calculations, the blast radius of the minimum daily amount of AN stored at the El Dorado facility (500,000 pounds approximately 960 feet from the proposed MF site) is between 3 and 5 psi which is well above the maximum allowable pressure of 0.5 psi, per the HUD Acceptable Separation Distance Guidance. The actual volume of AN may be greater than that used for the calculation, resulting in even higher blast pressures.

We did not consider the blast pressure wave mitigation that would be provided by the two small structures located on the El Dorado parcel between the potential MF site and the AN storage building, nor did we consider other possible mitigation measures that could be taken to reduce the potential effect of an accidental explosion. Based on our evaluation, the site located at South Bond Street and Echols Lane is not an appropriate multi-family housing site under the TDHCA 2015 Uniform Multifamily Rules.

REFERENCES

Database of Ammonium Nitrate storage facilities in Texas (https://apps.tdi.state.tx.us/ammoniumnitrate/StartAction.do)

Environmental Protection Agency, the Occupational Safety and Health Administration, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives, August 2013. *Chemical Advisory: Safe Storage, Handling, and Management of Ammonium Nitrate.*

EPA's Envirofacts database (http://www.epa.gov/enviro/index.html)

FM Global Property Loss Prevention Data Sheets 7-0 (April 2013). Causes and Effects of Fires and Explosions.

FM Global Property Loss Prevention Data Sheets 7-89 (October 2013). Ammonium Nitrate and Mixed Fertilizers Containing Ammonium Nitrate.

HUD Acceptable Separation Distance Guidebook (undated)

Texas Department of Housing & Community Affairs Multifamily Housing Rental Programs, 2015 Uniform Multifamily Rules.

Texas Department of Insurance website http://www.tdi.texas.gov/fire/fman.html

Texas State Fire Marshal's Office (512) 676-6800

Whitewright VFD, Jake Reynolds (Chief) 903-364-3000

Please contact Ashley Hutchens (562) 426-9544 if you have questions or need additional information.

Sincerely,

Ashley P. Hutchens

Ashley P. Hutchens, REPA
Project Manager
SCS ENGINEERS

Mike McLaughlin

Michael W. McLaughlin, P.E.
Senior Vice President
SCS ENGINEERS

Enclosures:

Figure 1 – Location of Proposed Multi-Family Property with Respect to El Dorado Chemical
Figure 2 – Blast-Overpressure (PSI) Radius for Storage of the Recorded Minimum Amount of Ammonium Nitrate (500,000 lbs) at El Dorado Chemical
Chemical Advisory: Safe Storage, Handling, and Management of Ammonium Nitrate (August 2013)
TDI Database of Ammonium Nitrate in Texas
EDR Facility Report (March 20, 2015)
TCEQ – Central Registry Query, Regulated Entity Information
Texas Department of Housing & Community Affairs Multifamily Housing Rental Programs, 2015 Uniform Multifamily Rules
HUD Acceptable Separation Distance Guidebook
FM Global Property Loss Prevention Data Sheets 7-0 (April 2013). Causes and Effects of Fires and Explosions
FM Global Property Loss Prevention Data Sheets 7-89 (October 2013). Ammonium Nitrate and Mixed Fertilizers Containing Ammonium Nitrate

Figures

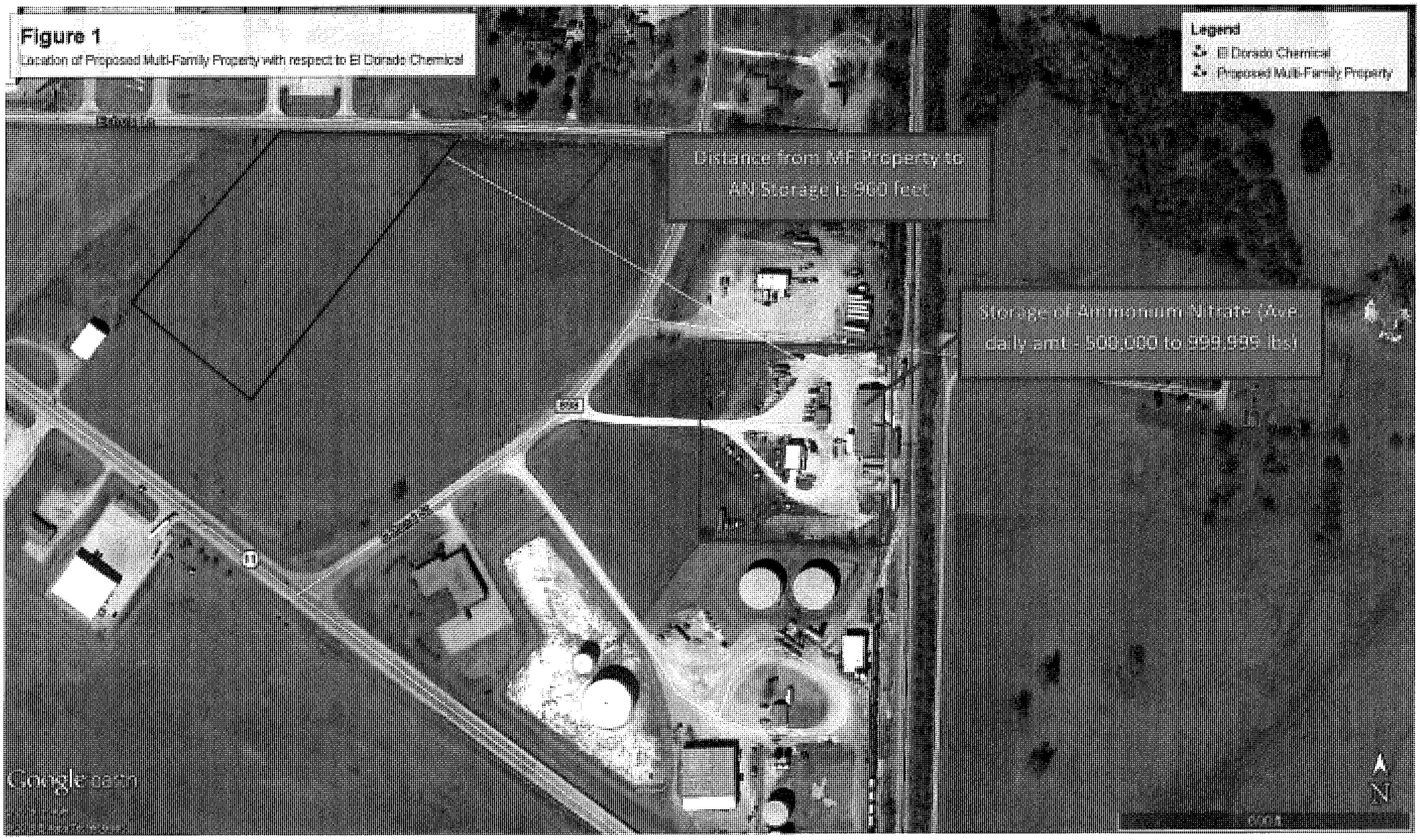


Figure 1. Location of Proposed Multi-Family Property with Respect to El Dorado Chemical.

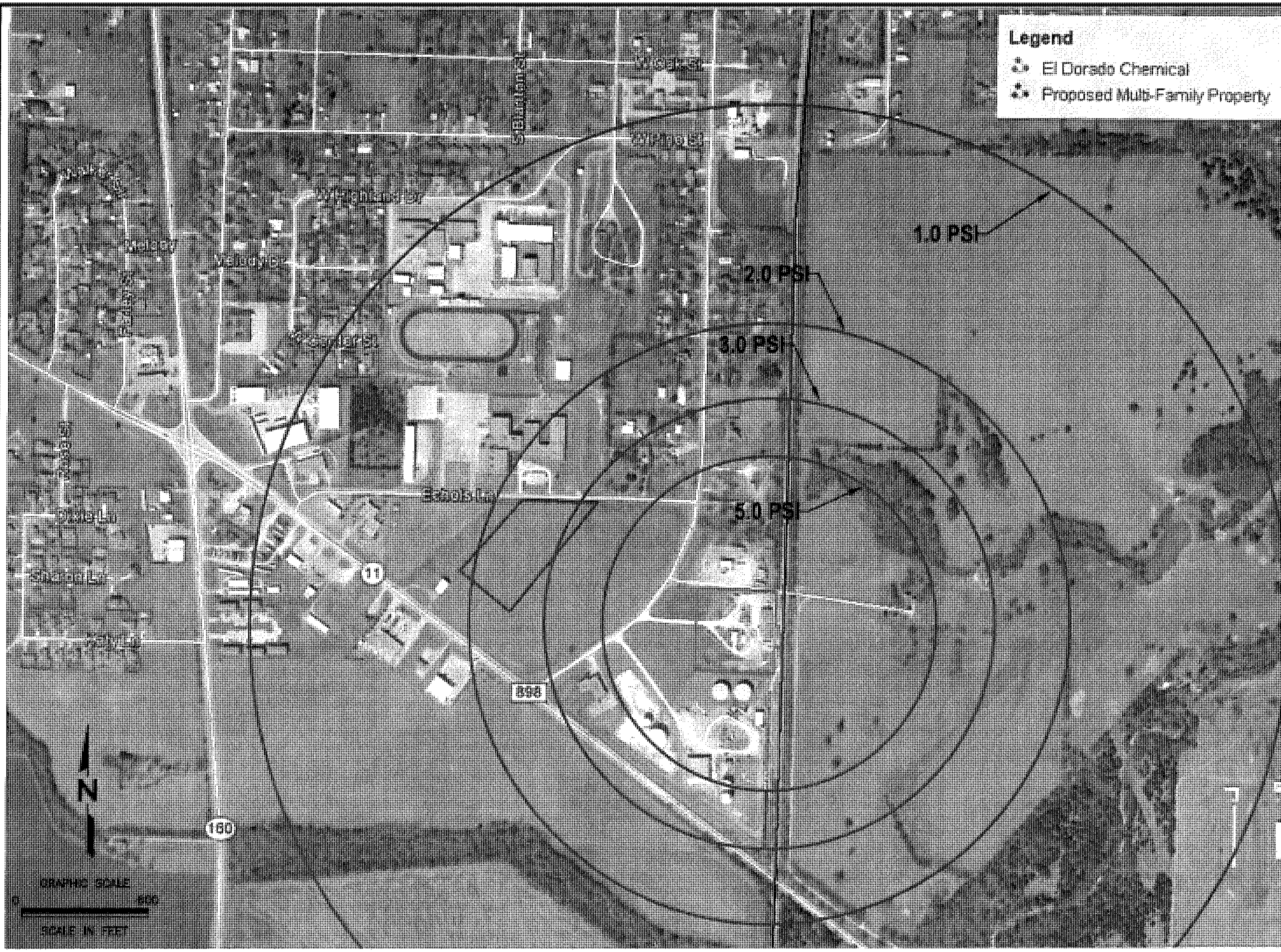


Figure 2. Blast-Overpressure (PSI) Radius for Storage of the Recorded Minimum Amount of Ammonium Nitrate (500,000 lbs) at El Dorado Chemical.

SCS ENGINEERS

Chemical Advisory: Safe Storage, Handling, and Management of Ammonium Nitrate (August 2013)

United States
Environmental Protection
Agency

Occupational Safety
and
Health Administration

Bureau of Alcohol,
Tobacco, Firearms
and Explosives

EPA 550-S-13-001 August 2013

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

EPA OSHA® ATF

The Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) ("we") are issuing this advisory[1] as part of an ongoing federal effort to improve chemical risk management, and to advance safety and protect human health and the environment. This advisory contains information on recent and past accidents involving AMMONIUM NITRATE (commonly referred to as AN), on the hazards of AN, how to manage these hazards, and appropriate steps for community emergency planning and proper emergency response. It is focused primarily on safe handling and storage of higher density, solid AN pellets and prills (a prill is a small bead) used in fertilizers. This advisory is intended to broadly disseminate lessons learned from recent incidents involving AN so that such incidents can be prevented in the future. Also provided is a list of information resources, including relevant codes and standards, industry publications, and applicable statutes and regulations that will help facilities handling AN and first responders better understand the hazards so they can effectively manage the risks. The information provided is not intended to cover all the hazards, safe practices or technical challenges associated with the manufacturing of AN; liquid fertilizers containing AN; manufacturing, storage or use of explosives or blasting agents containing AN; or the transportation of AN. For these particular situations, please consult other sources including the appropriate references, standards and regulations, cited at the end of this document.

ACCIDENTS

In general, AN is manufactured for use as a fertilizer and to produce explosives and blasting agents.[2] There are several other uses in the chemical industry, such as the production of nitrous oxide. These other uses represent a small fraction of amount of AN used in the US.

Although pure AN is stable at ambient temperature and pressure under many conditions, the chemical itself does not burn. AN is a strong oxidizer[3] and it supports and accelerates the combustion of organic (and some inorganic) material, increasing the fire hazard and complicating the fire fighting challenges. AN may explode when exposed to strong shock or when subjected to high temperatures in confinement.

Millions of tons of AN are produced annually in the US. Incidents involving AN are rare, but as is shown in the accidents below, they can have severe consequences. Most recently, on April 17, 2013, a fire at a fertilizer storage and distribution facility in West, Texas, resulted in a detonation of AN fertilizer stored at the facility, killing 15 people, including some of the firefighters responding to the fire. That incident remains under investigation,[4] but much has been learned from other AN explosions.

---

[1] The statements in this document are intended solely as guidance. This document is not a substitute for EPA, OSHA, ATF or other agencies' regulations, nor is it a regulation itself. It cannot and does not impose legally binding requirements on the agencies, states, or the regulated community. The measures described in this document may not apply to a particular situation based upon the circumstances. This guidance does not represent final agency action and may change in the future, as appropriate.

[2] A blasting agent is any material or mixture, consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive and in which none of the ingredients are classified as an explosive, provided that the finished product, as mixed and packaged for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined (see 29 CFR 1910.109(a)(1))

[3] An oxidizer is a material that readily yields oxygen or other oxidizing gas or that reacts readily to promote or initiate combustion of combustible materials.

[4] The precise quantity and form of AN has not been definitively established. We intend to update this advisory as we learn more about the incident and as we identify additional best practices.

- On October 2, 2003, a fire and explosion occurred in a double story farm warehouse in St. Romain en Jarez, France, involving 3 to 5 tons of AN stored in bags. This incident killed 26 people, 18 of whom were firefighters. In this incident, improper storage methods are thought to have played a role.

- On September 21, 2001, a massive explosion occurred in a warehouse at the Azote de France fertilizer factory in Toulouse, France, involving 200-300 tons of AN, which was stored in bulk in a hangar. The explosion resulted in the death of 30 people, 2500 injuries, the destruction of the factory, and an additional 10,000 buildings being heavily damaged. The exact cause of this accident remains unknown. Storage of incompatible material with AN is believed to have been a factor.

We have learned several key lessons as a result of these accidents and additions studies of AN, including:

The conditions of storage and the materials co-located with AN while in storage are crucial to the safety and stability of the AN.

Explosions of stored AN are responsible for some of the worst chemical disasters on record. Several of these incidents, including two in Germany in 1921, occurred during attempts to break up large piles of solidified or caked AN and ammonium sulfate mixtures using explosives. In both cases, the initial blast intended to break up solid AN initiated an unintended general detonation of the AN or ammonium sulfate mixture.

AN will self-confine under some conditions. Adding heat, such as a booster charge intended to break up clumps, can initiate a general detonation of the AN.

Other large explosions have been triggered by fires involving AN in confined spaces, including the 1947 explosion in Texas City, Texas, of two cargo ships. In that case, the first ship is thought to have exploded due to a fire in the hold involving AN fertilizer that had been manufactured with a wax coating and stored in paper bags. The wax would have been one potential source of fuel for mixing with the AN, thus creating an explosive situation. The second ship exploded some time later, likely due to a fire caused by the first explosion. These two explosions resulted in deaths of nearly 600, including all but one member of the Texas City Fire Department.

As a result of such accidents and subsequent studies of the properties of AN, caked AN is no longer broken up with explosive materials, and organic material such as wax coatings are no longer used for AN fertilizer.

Our intent in issuing this advisory is to identify actions that should be taken as a result of the lessons learned from the more recent accidents involving AN. Similar to the corrective steps taken following the 1921 and 1947 incidents, this advisory emphasizes the safe steps that should become common practice in the industry and emergency response community in order to prevent the catastrophic loss of life and property damage.

Here are some of the things we have learned from accidents involving AN:

AN will self-compress/self-confine under some conditions, becoming much more likely to explode.

AN is at risk for explosion when stored near other material that can add fuel to the AN – such as grain, sugar, seeds, sawdust, and most especially petroleum fuels such as diesel.

AN is a powerful oxidizer and a rich source of nitrate, which provides energy to an explosion. Thus, the presence of fuel and/or heat (and especially both) near AN is a very high hazard situation.

INFORMATION ON HAZARDS

Hazard Classification

For the purpose of transportation, AN that contains less than 0.2 percent combustible substances and AN fertilizers are classified by the U.S. Department of Transportation (DOT), as oxidizers. **AN with more than 0.2 percent combustible substances is classified by DOT as an explosive.**[5] (see box below).

The National Fire Protection Association (NFPA) assigns an instability rating of 3 (in a range of 0-4) to AN, meaning AN is capable of detonation, explosive decomposition, or explosive reaction, but that a strong initiating source or confinement in extreme temperatures is required. AN can explode under certain conditions by adding energy (heat, shock), especially when contaminants are present or it is under confinement.

"Pure" ammonium nitrate is stable and will explode only under extraordinary circumstances. However, the addition of combustible materials such as sugar, grain dust, seed husks or other organic contaminants, even in fairly low percentages, creates a dangerous combination and the ammonium nitrate mixture becomes far more susceptible to detonation. This characteristic of ammonium nitrate underlies most of the advice and recommendations for safe handling contained herein.

Decomposition Chemistry

AN melts at 337° F (170° C) and begins to undergo decomposition when molten. Hazardous scenarios with AN can involve simple thermal decomposition initiated by external fire or other heating, self-sustained decomposition also known as "cigar burning," and detonation.

Decomposition creates toxic gases containing ammonia and nitrogen oxides. The resulting nitrogen oxides will support combustion, even in the absence of other oxygen. The resulting heat and pressure from the decomposition of AN may build up if the reaction takes place in a confined space and the heat

[5] *Explosive* means any substance or article, including a device, which is designed to function by explosion (*i.e.,* an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion (see 49 CFR 173.50(a)).

and gases created are not able to dissipate. As the temperature rises, the rate of decomposition increases. In a confined space, the pressure can reach dangerous levels and cause an explosion that will include the detonation of the AN.

When dealing with a large quantity of AN, localized areas of high temperature may be sufficiently confined by the mass of material to initiate an explosion. The explosion of a small quantity of AN in a confined space (e.g., a pipe) may act as a booster charge and initiate the explosion of larger quantities (e.g., in an associated vessel).

During a fire in a facility where AN is present, the AN can become hot and molten which makes the material very sensitive to shock and detonation, particularly if it becomes contaminated with incompatible material such as combustibles, flammable liquids, acids, chlorates, chlorides, sulfur, metals, charcoal, sawdust, etc. If a molten mass becomes confined (e.g., in drains, pipes or machinery), it can explode.

Most types of AN do not continue to decompose once a fire has been extinguished. However, some types of AN fertilizers containing a small percentage of chlorides (e.g., potassium chloride) undergo a smoldering (self-sustaining) decomposition that can spread throughout the mass to produce substantial toxic fumes, even when the initial heat source is removed. These fertilizers that can self-sustain decomposition, known as "cigar burners" are normally compound fertilizers that contain between 5% to 25% nitrogen from ammonium nitrate, up to 20% phosphate (as P_2O_5) and chloride (which may only be present as a small percentage).

Contaminants

AN mixed with oil or other sensitizing contaminants may explode or detonate when exposed to fire or shock. Organic materials (e.g., packing materials, seed, etc.) will increase the likelihood of an explosion and will make the AN explosion more energetic.

AN may also be sensitized by certain inorganic contaminants, including chlorides and some metals, such as aluminum powder, chromium, copper, cobalt, and nickel.

As AN solution becomes more acidic, its stability decreases, and it may be more likely to explode.

Solid AN readily absorbs moisture, which can lead to caking, self-compression and self confinement. This in turn increases susceptibility to explosion in a fire.

The density, particle size and concentration of solid AN in a material, as well as the presence of other additives, affects the hazard of the material. The technical grade of AN is a lower density (higher porosity) prilled material. Higher density prills are used as fertilizer. AN can be fused with ammonium sulfate fertilizer or amended with carbonate materials to reduce its explosive properties. More information on additives is discussed in *Guidance for the Storage, Handling and Transportation of Solid Mineral Fertilizers* found in the Reference section. Solid fertilizers are usually coated with an inorganic, non-combustible anti-caking compound to prevent sticking and clumping.

AN in undiluted or pure form has a higher degree of overall hazard than when it is mixed or blended with compatible or non-combustible materials that can reduce the concentration. In general for fertilizer blends containing AN, the more nitrogen they contain, the greater the explosion hazard they pose. Blended fertilizers containing AN and chloride compounds and blended fertilizers containing AN contaminated with combustible materials or incompatible substances pose increased explosion hazards. A large number of blended fertilizers are produced from basic primary fertilizer products (e.g., ammonium nitrate, urea, and mono-ammonium phosphate) and natural materials (e.g., rock phosphate, potassium chloride) which can introduce contaminants. All such materials are not necessarily compatible with each other and some may produce undesirable effects when mixed with others. These undesirable effects can include, for example, chemical reaction(s) and physical effects (e.g. stickiness which can cause handling difficulties, moisture migration giving rise to caking tendency). Facilities can consult *Guidance for Compatibility of Fertilizer Blending Materials* listed in the Reference section to assess potential incompatibility. The Safety Data Sheet (SDS – formerly MSDS) of the AN product should be used as one source of information to assess the overall hazard. The effects of added components can only be determined after careful review of the SDS and other available hazard literature.

Confinement and/or the addition of fuel to AN creates a real danger of explosion. The addition of heat when either of these conditions exists can lead to disaster. Accordingly, the responder should quickly assess if AN has been involved in the fire and whether the AN has been compromised in any of these ways, and plan the fire response accordingly.

HAZARD REDUCTION

What steps should facility owners or operators take to reduce the hazards of AN during storage and handling?

Storage/Process Conditions to Avoid

Persons engaged in the handling, management or emergency planning for AN must be aware of the hazards of AN and ensure that the conditions that may lead to an explosion are not present. Measures that facilities should take to ensure the safe storage, use and handling of AN include:

- Avoid heating AN in a confined space.
  - Processes involving AN should be designed to avoid this possibility.
  - Avoid localized heating of AN, potentially leading to development of high temperature areas (e.g., AN fertilizer should not be stored near sources of heat such as steam pipes, radiators, hot ducts, light bulbs etc.).
- Ensure that AN is not exposed to strong shock waves from explosives. AN storage near high explosives or blasting agents must conform to ATF's Table of Separation Distances, Title 22 of the Code of Federal Regulations, section 555.220 (22 CFR 555.220).

- Avoid contamination of AN with combustible materials or organic substances such as packing materials, dust, seed, oils, and waxes.
  - If possible, do not co-locate AN, especially bulk AN in bins, with dust-producing organics such as grains or seeds.
- Avoid contamination of AN with inorganic materials that may contribute to its sensitivity to explosion, including chlorides and some metals, such as aluminum powder, chromium, copper, cobalt, and nickel.
  - Pay attention to the materials used to build storage areas and cribs. Wood and aluminum or other metals must be specially treated to prevent impregnation if they are going to be in contact with AN. Metal materials can be treated with epoxy tar or chlorinated rubbers to prevent corrosion of the metal and contamination of the AN.
- Maintain the pH of AN solutions within the safe operating range of the process. In particular, avoid low pH (acidic) conditions.
  - If possible, do not co-locate acids in an AN storage area.
- Keep molten or solid AN out of confined spaces, especially sewers or drains where it can react with organic materials there.

Certain specific safety and handling instructions (required and recommended) apply for safe handling and storage of AN[6] under certain conditions:

OSHA's standard for Explosives and Blasting Agents at 29 CFR 1910.109(i) contains requirements for AN stored in the form of crystals, flakes, grains or prills including fertilizer grade, dynamite grade, nitrous oxide grade, technical grade, and other mixtures containing 60 percent or more of AN by weight. AN should also be handled in accordance with safe practices found in *NFPA 400 Hazardous Materials Code, Chapter 11.*

Building Design

- Store only in one-story buildings and buildings with no basements, unless the basement is open on one side.
- Use fire resistant walls within 50 feet of combustible building or materials.
- Flooring in storage and handling areas should be constructed of noncombustible material or protected from impregnation by AN.
- Avoid installing, or remove or close off any open drains, traps, tunnels, pits or pockets into which molten AN can flow and be confined in the event of fire.
- Buildings should be kept dry and free of water seepage through roofs, walls and floors.
- Have adequate ventilation or be constructed to self-ventilate in the event of a fire to avoid pressurization.
- Do not place AN into storage when the temperature of the product exceeds 130°F (54.4°C).

[6] AN-based materials that are DOT Hazard Class 1 sensitive (explosives or blasting agents) must be handled and stored in accordance with requirements of OSHA's Standard for Explosives and Blasting Agents (29 CFR 1910.109) and ATF's Table of Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents (27 CFR 555.220) Facilities should also follow the NFPA 495- Explosive Materials Code, where applicable.

Storage in bags, drums or other containers

- Piles of bags, drums and other containers should be no closer than 36 inches below the roof or supporting beams.
- Bags should be stored no less than 30 inches from walls or partitions.
- Piles of bags, drums, and other containers should not exceed a height of 20 feet, width of 20 feet, and length of 50 feet, unless the building is of noncombustible construction or protected by automatic sprinklers.
- Maintain aisles of at least 3 feet width between piles.

Storage in bulk

- Bins for storing bulk AN should be kept clean and free of materials, which could contaminate the material. Bins should not be constructed of galvanized iron, copper, lead or zinc unless suitably protected. Aluminum or wooden bins should be protected against impregnation by AN.
- Piles or bins must be adequately sized, arranged and moved periodically to minimize caking. Height or depth of piles shall be limited by pressure-setting tendency of the product, but in no case should pile be higher than 36 inches below roof or supporting beams.
- Do NOT use dynamite, explosives or blasting agents to break up or loosen caked AN.
- Protect piles of AN from absorbing moisture from humid air by covering them with water-impermeable sheeting or using air conditioning.
- Do not store AN with organic chemicals, acids, or other corrosive materials, materials that may require blasting during processing or handling, compressed flammable gases, flammable and combustible materials or other contaminating substances. AN stores should be separated from incompatible substances by using separate buildings or 1 – hour fire resistant walls, or a minimum separation distance of 30 feet.

Fire Protection

- AN storage areas should be equipped with an automatic sprinkler system, or have an automatic fire detection and alarm system if the areas are not continuously occupied. This is especially important when the facility in question is close to the public surrounding the facility.
- Facilities should NOT store more than 2500 tons of bagged AN without an automatic sprinkler system.
- An automatic sprinkler system, if installed, should be provided in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.
- Suitable fire control devices such as hoses and appropriate portable fire extinguishers (AN is an oxidizer and not all fire extinguishers are appropriate) shall be provided throughout the warehouse and loading areas. Water supplies and fire hydrants should be available.
- Store AN fertilizer in separate buildings or separated by approved fire walls from organic, combustible or reactive materials, such as grains, wood or other organic materials, urea and urea compounds, flammable liquids or gases, corrosive acids, chlorates, chromates nitrites, permanganates or finely divided metals or sulfur.

- AN fertilizer should NOT be stored in the same building with explosives or blasting agents unless conditions in ATF's Table of Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives and Blasting Agents, 27 CFR 555.220, are met.
- Prohibit smoking in AN storage areas.

We recommend that AN be stored in purpose-built facilities/buildings of non-combustible construction. Dust-producing organic materials, such as grain, seeds and sugar, should not be stored near AN. Some metal powders such as aluminum powder are equally dangerous. AN should be stored so as to ensure it is not contaminated by gasoline, diesel or other fuels, and is not subject to high heat (even in one small area of a large stockpile) or water infiltration.

COMMUNITY EMERGENCY PLANNING

What should communities do to understand and develop a plan for the risk associated with AN?

AN is a hazardous chemical covered under the OSHA Hazard Communication Standard. Therefore, facilities that handle and store AN are required by law to submit information regarding chemical hazards (including AN) to their State or Tribal Emergency Response Commission (SERC or TERC), Local Emergency Planning Committee (LEPC), and local fire department. This information must include the following:

1) a Safety Data Sheets (SDS) providing the chemical's hazard information and emergency response guidelines and
2) a Hazardous Chemical Inventory form that provides the quantity, storage types and locations of the AN at their facility.

We recommend that fire services visit any facility reporting AN, and that the conditions of storage and manner of handling be reviewed by fire service personnel. Fire service and other emergency responders should take note of the specific location(s), amounts and packaging of stored AN. Conditions of storage should be reviewed with the facility operator in light of the information provided in this document.

The LEPC in conjunction with the fire department should use this information to develop an emergency plan, in case of a fire or explosion involving AN or any other hazardous substance. The facility should consult with the LEPC to provide them the necessary information to develop the emergency plan, the elements of which should include:

- Identification of facilities and transportation routes of hazardous substances
- Description of emergency response procedures, on and off site
- Designation of a community coordinator and facility emergency coordinator(s) to implement the plan

- Outline of emergency notification procedures
- Description of how to determine the probable area and population affected by releases
- Description of local emergency equipment and facilities and the persons responsible for them
- Outline of evacuation plans
- A training program for emergency responders (including schedules)
- Methods and schedules for exercising emergency response plans

LEPCs should also ensure that members of the community (which would include potentially affected populations) are aware of the emergency plan and the actions they need to take if an accident occurs.

Local fire departments should use the information to determine what precautions they may need to take in responding to an accident at the facility and ensure the first responders have the appropriate training to respond to incidents involving AN.

Owners and operators of facilities holding AN are required to report the AN hazard to local response officials under the Emergency Planning and Community Right-to-Know Act (EPCRA). Unfortunately, that obligation is not universally understood, and so some facilities may fail to report. Fertilizer-grade AN is typically found at those businesses that provide direct logistical support to agriculture. This may include crop service operations, farm co-ops, grange stores and similar operations.

In the interest of community safety, it is often necessary and appropriate for first response officials to reach out to facility owners and operators, and determine if unreported risks are present in their community. Helping a neighbor, facility operator, or employer to understand and meet his obligations to the community and to workers is in everyone's best interest

EMERGENCY RESPONSE

Owner/operators of storage facilities should develop a site emergency response plan which includes:

- Coordination with local first responders
- Joint training with first responders if possible
- Employee training
- Community outreach
- Analysis of what may be at risk in a serious accident and appropriate planning
- Signs that clearly mark high hazard areas, safe areas, emergency contact numbers, firefighting equipment, and other essential area during an emergency response
- A site and area evacuation plan

Owners and operators of facilities holding AN have an obligation to ensure their community's first responders are aware of the hazards associated with the AN. Reliance on a report may not always be sufficient. Owners and operators should take a pro-active approach to reaching out to the emergency response officials in their location and ensuring that the hazards of AN are understood by the responders.

What do firefighters need to know when responding to an accident or fire involving AN?

Before responding to a fire involving AN, firefighters should ensure the community emergency response plan includes:

- AN hazard information and emergency response guidelines
- Quantity, storage types, and locations of AN at facilities in their community
- Specific response procedures; including a decision process to determine under which conditions a fire should be fought or whether the fire should be allowed to burn
- Evacuation procedures for the community
- Training requirements for all response personnel
- A schedule for exercising the response plan related to AN accidents

When responding to a fire where AN is stored; firefighters should:

- First consider if they can safety fight the fire or whether they should just let it burn, move to a safe location, and focus on evacuating nearby residents and preventing further safety issues for the surrounding community.

To determine whether or not it makes sense to fight the fire or to let it burn, firefighters and emergency responders should consider the following information:

- Firefighters should not fight an AN fire and everyone, including fire fighters, should be evacuated to a safe distance if they observe any of the following:
  - A fire involving AN is judged to be out of control;
  - The fire is engulfing the AN; or
  - Brown/orange smoke is detected, indicating the presence of nitrogen dioxide (which is toxic); or
  - A rapid increase in the amount/intensity of smoke or fire in the area of AN storage.

- If firefighters consider it safe and appropriate to respond to a fire involving AN, then the following information should be considered:
  - AN fires should be fought from protected locations or maximum possible distance. Approach a fire involving or close to AN from upwind to avoid hazardous vapors and toxic decomposition products. Self-contained breathing apparatus (SCBA) of types approved by the National Institute for Occupational Safety and Health (NIOSH) should be used to protect personnel against gases.
  - Use flooding quantities of water from a distance as promptly as possible. It is important that the mass of AN be kept cool and the burning be quickly extinguished. Keep adjacent fertilizers cool by spraying with large amounts of water. When possible and appropriate, only use unmanned hose holders or monitor nozzles.

- Do NOT use steam, CO_2, dry powder or foam extinguishers, sand or other smothering agents.[7]
- Ensure maximum ventilation of the AN storage container as quickly as practical to prevent heat and pressure buildup. This is different than ensuring maximum ventilation of the entire building or structure where the AN is stored. Ventilation of the structure should be conducted only in a manner to limit fire spread and growth and should be minimized until a suppression water supply is established.
- If practicable and safe to do so, attempt to prevent AN from entering the drains where explosive confinement could occur. Remember AN may be washed into drains by fire water, but it can also melt and flow without impetus from water.
- Prevent or minimize contamination of water bodies or streams to reduce the potential for environmental effects.

INFORMATION RESOURCES

CODES AND STANDARDS

NFPA codes and Compressed Gas Association (CGA) standards are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing various viewpoints and interests to achieve consensus on safety issues. These codes and standards are not binding but may be adopted by reference into laws or regulations. Users of the codes and standards should consult applicable federal, state and local laws and regulations.

NFPA has developed a code for storage of AN, including mixtures containing 60 percent or more by weight of AN, and a code for explosives that would apply to blasting agents and explosives containing AN. These codes are listed below:

> *NFPA 400 — Hazardous Materials Code,* Chapter *11 - Ammonium Nitrate Solids and Liquids*. (2013). Also see Annex A.11 in this document and Annex E: Properties and Uses of Ammonium Nitrate and Fire-Fighting Procedures.
>
> *NFPA 495 — Explosive Materials Code* (2013).
>
> National Fire Protection Association
> 1 Batterymarch Park
> PO Box 9101
> Quincy, MA 02169-7471
> Phone: 800-344-3555 (toll free)
> Website: http://www.nfpa.org/freeaccess

[7] Keep in mind that ammonium nitrate is an oxidizer – that is – it provides its own oxygen and once combustion begins, it cannot be smothered. Moreover, the combination of heat and confinement will accelerate combustion, perhaps to the point of detonation.

Safe Practices for the Production of Nitrous Oxide From Ammonium Nitrate, CGA G-8.4 (January 2013). Compressed Gas Association, Inc., Chantilly, VA
http://www.cganet.com/customer/publication_detail.aspx?id=G-8.4

GENERAL REFERENCES

Storing and Handling Ammonium Nitrate, INDG230 (First published 8/96, Reprinted 11/04). Health and Safety Executive (HSE), United Kingdom http://www.hse.gov.uk/explosives/ammonium/

Safe Storage and Handling of Ammonium Nitrate (AN), Technical Note 60, (28/02/2006), SafeWork, South Australia. http://www.safework.sa.gov.au/uploaded_files/SSAN_Storage.T60.pdf

Safe Practice: Safe Storage of Solid Ammonium Nitrate. (2013). Resources Safety, Division of Mines and Petroleum, Government of Western Australia (WA), East Perth, WA.
http://www.dmp.wa.gov.au/documents/Code_of_Practice/DGS_COP__StorageSolidAmmoniumNitrate.pdf

Guidance for the Storage, Handling and Transportation of Solid Mineral Fertilizers. (2007). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org

Guidance for the Safe Handling and use of Non-conforming Fertilizers and Related Materials (Producers). (2003). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org

Guidance for the Safe Handling and Use of Non-conforming Fertilizers and Related Materials for Fertilizer Importers, Distributors and Merchants. (2004). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org

Guidance for the Storage of Hot Ammonium Nitrate Solution. (2005). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org

Guidance for Compatibility of Fertilizer Blending Materials. (2006). European Fertilizers Manufacturers Association, Brussels, Belgium, www.efma.org

The above five guidance documents from European Fertilizers Manufacturers Association can be found on the following webpage:

http://www.productstewardship.eu/site/index.php?id=259

Ammonium Nitrate and Mixed Fertilizers Containing Ammonium Nitrate, FM Global Property Loss Prevention Data Sheet 7-89. (April 2013). FM Global, Johnston, Rhode Island.
http://www.fmglobal.com/page.aspx?id=04010200 Free access with registration

Ammonium Nitrate Handling, (2013). Bunn Fertiliser, Ltd.
http://www.bunnfertiliser.com/infocentre/bunnhealthsafety/ammoniumnitratehandling/

Ammonium Nitrate, Industrial Grade, Technical Information. (2011) Dyno Nobel Inc. http://www.dynonobel.com/files/2010/04/1Ammonium_Nitrate_LomoDonora-Industrial.pdf

Ammonium Nitrate, Nutrient Source Specific (NSS) Fact Sheet, No. 22 International Plant Nutrition Institute, Norcross, GA
http://www.ipni.net/publication/nss.nsf/0/67265A0AC9302CC5852579AF0076927A/$FILE/NSS-22%20Amm%20Nit.pdf

Fire Protection Guide to Hazardous Materials, 14th edition. (2010). National Fire Protection Association, Quincy, MA.

Guide No. 140 for Oxidizers , *Emergency Response Guidebook.* 2012. US Dept. of Transportation, Pipeline and Hazardous Materials Safety Administration.
http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2012.pdf

EPA Chemical Accident Investigation Report, Terra Industries, Inc., Nitrogen Fertilizer Facility, Port Neal, Iowa. (January, 1996). U.S. Environmental Protection Agency, Region 7, Emergency Response and Removal Branch, Kansas City, KS. http://www.epa.gov/emergencies/docs/chem/cterra.pdf

West Fertilizer Explosion and Fire. (2013). U.S. Chemical Safety Board
http://www.csb.gov/west-fertilizer-explosion-and-fire-/

The National Safety Council has a data sheet *Ammonium Nitrate Fertilizer, Data Sheet I-699.* (1991) that discusses the health hazards, properties, and precautions for safe storage and handling of AN fertilizer.

> National Safety Council
> 1121 Spring Lake Drive
> Itasca, IL 60143-3201
> Phone: (800) 621-7269 (toll free) or (630)-775-2199 (Library)
> Website: http://www.nsc.org

The Fertilizer Institute (TFI) possesses information on various fertilizer products, including AN, and their uses.

> The Fertilizer Institute
> 425 Third Street, SW, Suite 950
> Washington, DC 20024
> Phone: (202) 962-0490
> Website: http://www.tfi.org

ResponsibleAg (RA) is a Fertilizer Code of Practice management system that helps facilities establish basic Environmental, Health, Safety and Security (EHS&S) performance practices. ResponsibleAg is a joint venture of the Agricultural Retailers Association (ARA) and The Fertilizer Institute (TFI). ARA also has a *First Responder Guidance* for use by agricultural retailers, LEPCs and local first responders. For more information, contact:

Agricultural Retailers Association
1156 15th Street, NW
Suite 500
Washington, D.C. 20005
Phone: 202-457-0825
Website: www.aradc.org

For more detailed information on the safe handling practices for storage of explosive materials which may contain AN, please consult the following Safety Library Publications (SLPs) developed by the Institute of Explosive Makers (IME).

- *Construction Guide for Storage Magazines,* IME SLP No. 1 (September 2006).
- *The American Table of Distances*, IME SLP No. 2 . (October 2011).
- *Suggested Code of Regulations for the Manufacture, Transportation, Storage, Sale, Possession, and Use of Explosive Materials*, IME SLP No. 3. (October 2009).
- *Handbook for the Transportation and Distribution of Explosive Material,* IME SLP No. 14. (April 2007).
- *Safety in the Transportation, Storage and Use of Explosive Materials,* IME SLP No. 17 (October 2011).
- *Recommendations for the Transportation of Explosives, Division 1.5, Ammonium Nitrate Emulsions, Division 5.1, Combustible Liquids, Class 3, and Corrosives, and Liquids, Class 8 in Bulk Packaging*, IME SLP No. 23. (October 2011).
- *Explosives Manufacturing and Processing Guide to Safety Training,* IME SLP No. 25. (May 2011).

SLPs are available at http://www.ime.org/ecommerce/products.php?category_id=13

Institute of Makers of Explosives (IME)
1120 Nineteenth St. N.W. Suite 310
Washington, DC 20036-3605
Phone: (202) 429-9280
Website: www.ime.org

SAFEX International is an industry group whose members manufacture civil or military explosives or technical grade ammonium nitrate (TGAN). TGAN is generally in the form of porous prills and is used in the manufacture of commercial explosives. SAFEX has published a guide for safe storage of TGAN listed below that is available to its members. https://www.safex-international.org/_index.php

Good Practice Guide: Storage of Solid Technical Grade Ammonium Nitrate. (March 2011). International Working Group on Ammonium Nitrate, SAFEX International. SAFEX Good Explosive Practice Series, GPG 02 rev. 1

STATUTES AND REGULATIONS

Statutes and regulations applicable to the manufacture of or processes involving AN, are listed below.

Clean Air Act Accident Prevention- General Duty (EPA)

Section 112(r) of the Clean Air Act (CAA) focuses on prevention of chemical accidents. Under this provision of the CAA, all facilities with regulated substances or other extremely hazardous substances have a general duty to prevent and mitigate accidental releases. Under Section 112(r)(1), the general duty is :

> to identify hazards ...using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur.

This general duty applies to facilities producing, processing, handling or storing extremely hazardous substances. While not a regulated substance, AN may be considered extremely hazardous under certain circumstances.

Clean Air Act- Risk Management Program (EPA) and Process Safety Management (OSHA)

In 1990, amendments to the CAA authorized the EPA's Risk Management Program (RMP) Rule (40 CFR Part 68) under section 112(r), and required the Occupational Health and Safety Administration (OSHA) to issue the Process Safety Management Program (PSM) rule. Both rules serve to prevent chemical accidents. The RMP focuses on prevention and mitigation of accidental releases of listed toxic and flammable substances. Requirements under the RMP rule include development of a hazard assessment, a prevention program, and an emergency response program. While AN is not a listed substance subject to the RMP, chemicals used in the production of AN are included on the RMP list, making the process producing AN potentially subject to the RMP. Certain processes using AN may also involve RMP listed substances. For more information about RMP regulations, see http://www.epa.gov/emergencies/content/rmp/index.htm

OSHA's Process Safety Management (PSM) Standard establishes requirements intended to protect employees by preventing or minimizing the consequences of chemical accidents involving highly hazardous chemicals (29 CFR 1910.119). Although AN is not covered by the PSM standard, the production or use of AN may involve PSM listed chemicals in excess of thresholds. Manufacture of explosives, which may involve AN, is also covered by the PSM standard. For more information about OSHA's PSM standard see https://www.osha.gov/SLTC/processsafetymanagement/index.html

Emergency Planning and Community Right-to-Know Act (EPA)

The Emergency Planning and Community Right-to-Know Act (EPCRA), requires information on the presence of hazardous chemicals above designated threshold quantities at regulated facilities be provided to state and local emergency planning authorities. This information facilitates development of emergency response plans required by section 303 of EPCRA, enhances community awareness of chemical hazards and help first responders to respond to chemical accidents. The chemicals covered under these requirements are a specific list of chemicals known as Extremely Hazardous Substances (EHSs) found at 40 CFR Part 355 Appendices A and B and any chemicals that meet the criteria as hazardous chemicals under OSHA's Hazard Communication Standard. AN is not an EHS but is considered a hazardous chemical (oxidizer) and therefore subject to the EPCRA provisions described below.

Section 311 of EPCRA requires facilities to submit Safety Data Sheets for the EHSs and hazardous chemicals to their State or Tribal Emergency Response Commission (SERC or TERC), Local Emergency Planning Committee (LEPC) and local fire department. Section 312 requires facilities to submit annually to their SERC or TERC, LEPC, and local fire department, Hazardous Chemical Inventory forms for these chemicals. The SDS provides the chemical's hazard information and emergency response guidelines and the Hazardous Chemical Inventory form provides the quantity, storage types and locations of the chemical at their facility. Regulations covering these requirements are found at 40 CFR Part 370.

Section 311(e)(5) of EPCRA does not include the following as a hazardous chemical: any substance used in routine agricultural operations or a fertilizer held for sale by a retailer to the ultimate customer. At fertilizer distributors, AN is commonly blended with other chemicals to produce a fertilizer mix according to customer specifications. Any AN that is mixed or formulated with other chemicals by facilities is not covered by the Section 311(e)(5) exemption. The exemption was intended to apply only to retailers of the substance, not to manufacturers and wholesalers – who typically have large quantities of fertilizers, and may use and manufacture a wide range of chemical compounds. These manufacturers and wholesalers can present significant risks that need to be addressed by emergency response authorities. For more information about EPCRA hazardous chemical reporting, see http://www.epa.gov/emergencies/content/epcra/index.htm

Environmental Protection Agency (EPA)
Phone: (800) 424-9346 or (703) 412-9810
Website: http://www.epa.gov

Explosives and Blasting Agents Standards (OSHA)

In addition to the PSM program described above, the Occupational Safety and Health Administration (OSHA) regulates the manufacture, keeping, having, storage, sale, transportation, and use of explosives and blasting agents under its Occupational Safety and Health Standards for explosives and blasting agents (29 CFR 1910.109). Blasting agents are frequently formulated with AN. For more information about OSHA's standards covering explosives and blasting agents, including ammonium nitrate and storage of all grades of ammonium nitrate, see https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9755&p_table=STANDARDS

Hazard Communication Standard (OSHA)

OSHA's Hazard Communication Standard (HCS) at 29 CFR 1910.1200 requires chemical manufacturers and importers to evaluate the hazards of the chemicals they produce or import, and prepare labels and Safety Data Sheets (SDS) to convey the hazard information to their downstream customers. All employers with hazardous chemicals in their workplaces must have labels and safety data sheets for their exposed workers, and train them to handle the chemicals appropriately. AN is a hazardous chemical covered under the HCS. The HCS is now aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Employers are required to train workers by December 1, 2013 on the new labels elements and safety data sheets format to facilitate recognition and understanding. For more information, see http://www.osha.gov/dsg/hazcom/index.html

Occupational Safety and Health Administration
Phone: (800) 321- OSHA (6742)
Website: http://www.osha.gov

Chemical Facility Anti-Terrorism Standards (DHS)

The Department of Homeland Security (DHS)'s Chemical Facility Anti-Terrorism Standards (CFATS) program applies to facilities that possess threshold quantities of certain types of ammonium nitrate. Facilities in possession of Chemicals of Interest (listed in 6 CFR Part 27 Appendix A) exceeding specific threshold quantities are required to complete a "Top-Screen" questionnaire to identify the types and quantities of Chemicals of Interest the facility possesses. For ammonium nitrate at any concentration (with more than 0.2% combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance) the Screening Threshold Quantity for risk of release is 5,000 pounds and for risk of theft is 400 pounds. This same form of ammonium nitrate is also classified by DOT as a Division 1.1 explosive. For solid ammonium nitrate, with a minimum concentration of 33% or greater and a nitrogen concentration of 23% nitrogen or greater, the Screening Threshold Quantity for risk of theft is 2,000 pounds. The CFATS program, first established under Section 550 of the 2007 DHS Appropriations Act, identifies and regulates high-risk chemical facilities to ensure they have security measures in place to reduce the risks associated with these chemicals. CFATS regulations are found in 6 CFR Part 27.

Based on the Top-Screen, if DHS initially determines the facility to be high-risk, the facility must complete and submit a Security Vulnerability Assessment, which is then reviewed by DHS to make a final determination on whether the facility is high-risk. Facilities receiving a final high-risk determination must develop and submit for DHS's review, a Site Security Plan (SSP), or alternatively, an Alternative Security Program, that describes the specific security measures the facility will utilize to meet the 18 applicable risk-based performance standards under CFATS. The agency must then conduct an inspection to help determine whether or not the facility's SSP should be approved. For more information about CFATS program, see http://www.dhs.gov/chemical-facility-anti-terrorism-standards

Hazardous Materials (DOT)

The Department of Transportation (DOT) regulates transportation of AN under its Hazardous Materials Regulations.

The following forms of ammonium nitrate are listing in the DOT Hazardous Materials Table (49 CFR 172.101) with their Hazard Class or Division:

Ammonium nitrate based fertilizer, 5.1
Ammonium nitrate based fertilizer, 9 (when transported by vessel or aircraft)
Ammonium nitrate emulsion or Ammonium nitrate suspension or Ammonium nitrate gel, intermediate for blasting explosives, 5.1
Ammonium nitrate-fuel oil mixture containing only prilled ammonium nitrate and fuel oil, 1.5D
Ammonium nitrate, liquid (hot concentrated solution), 5.1
Ammonium nitrate, with more than 0.2 percent combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance, 1.1D
Ammonium nitrate, with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other added substance, 5.1

Explanation of Hazard Class numbers:
1.1 - Explosives (with a mass explosion hazard) A mass explosion is one which affects almost the entire load instantaneously.
1.5 - Very insensitive explosives; blasting agents
5.1 - Oxidizer
9 - Miscellaneous Hazard Material

DOT also requires security plans for persons offering for transportation or transporting any quantity of a Division 1.1 or 1.5 material containing ammonium nitrate or large bulk quantities (greater than 6,614 lbs or 792 gals) of ammonium nitrate, ammonium nitrate fertilizers, or ammonium nitrate emulsions, suspensions, or gels. The security plan must conform to requirements in 49 CFR 172.800.

Department of Transportation
Phone: (202) 366-5580 - Public Information
Website: http://www.dot.gov

Explosives Regulations (ATF)

The Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) of the Department of the Justice regulates the importation, manufacture, distribution, and storage of explosive materials including blasting agents and other explosive materials containing AN. ATF's explosives regulations, 27 CFR Part 555, can be located at http://www.atf.gov/regulations-rulings/regulations/index.html

Bureau of Alcohol, Tobacco, Firearms, and Explosives
Phone: (202) 648-7120
Website: http://atf.gov

For More Information, Contact:

The Superfund, TRI, EPCRA, Risk Management Program, and Oil Information Center
(800) 424-9346 or (703) 412-9810
TDD (800) 553-7672 or (703) 412-3323

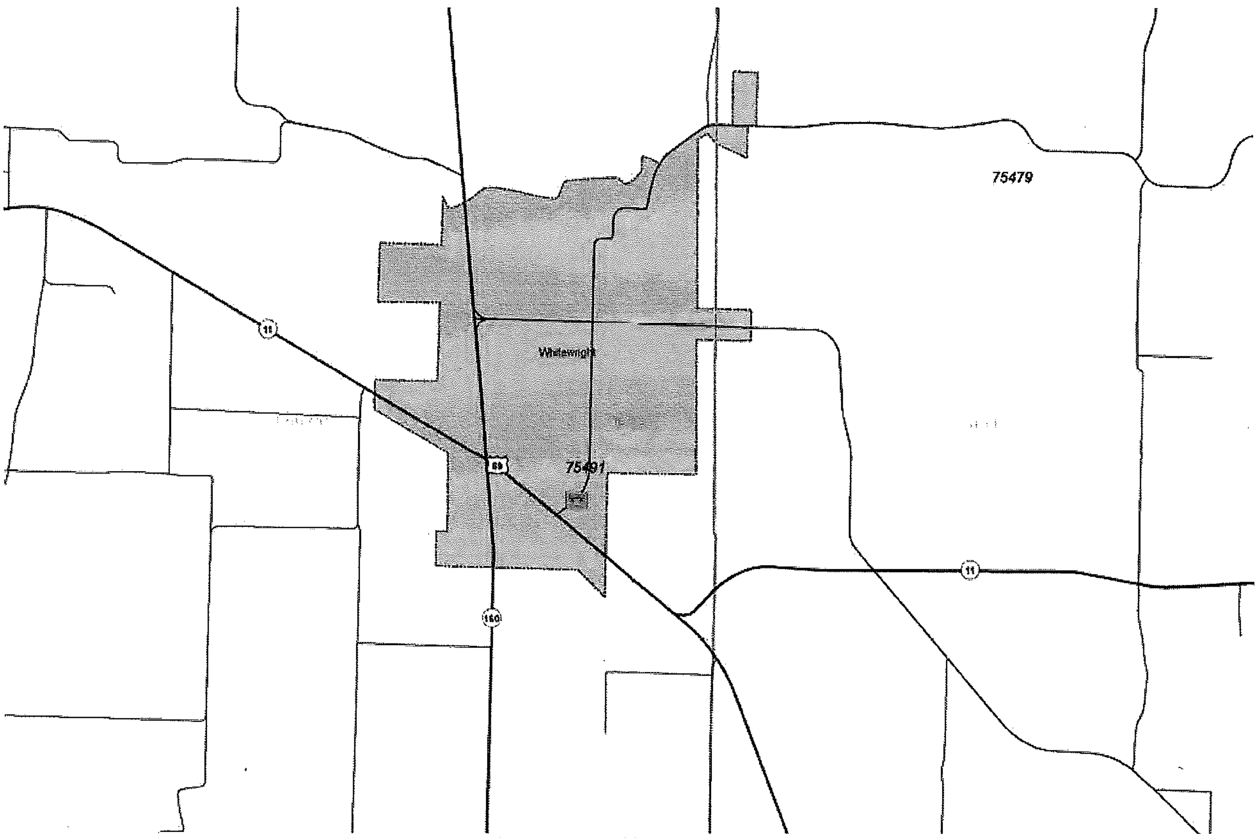
TDI Database of Ammonium Nitrate in Texas

TDI.TEXAS.GOV
TEXAS DEPARTMENT OF INSURANCE

Texas Department of Insurance | Back to Search |

Ammonium Nitrate in Texas

Storage Facilities in ZIP Code: 75491



There is one facility listed in that ZIP Code.

Storage Facility

Contact Information:
Whitewright VFD
Phone: (903) 364 - 5374

Back to Search
To learn more about the Tier II program go to the program's site at the Department of State Health Services
Homeland Security· State Search· Texas.gov
Accessibility / Policies· Compact with Texans· Contact Us· Site Map
Texas Department of Insurance & Office of Public Insurance Counsel

- V 2014.03.10 -

EDR Facility Report (March 20, 2015)

1102 SOUTH BOND STREET
1102 South Bond Street
Whitewright, TX 75491

Inquiry Number: 04239854.1r
March 20, 2015

EDR-AuditCheck™ Facility Report

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

The EDR-AuditCheck® Facility Report is a comprehensive presentation of government filings on a facility identified in a search of over 4 million government records from more than 600 federal, state and local environmental databases. The report is divided into three sections:

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

SECTION 1: FACILITY SUMMARY

Due to inconsistent name and/or locational information, records on the same facility may be listed in separate facility columns.

	RECORD 1 EL DORADO CHEMICAL CO WHITEWRIGHT PLANT 1102 S BOND ST WHITEWRIGHT, TX 75491 - 30 EDR ID #1011325891 EPA #110034317102	RECORD 2 EL DORADO CHEMICAL WH ITEWRIGHT PLANT 1102 S BOND ST WHITEWRIGHT, TX 75491 EDR ID #S113417076	RECORD 3 EL DORADO CHEMICAL CO MPANY 1102 SOUTH BOND STREET WHITEWRIGHT, TX 75491 EDR ID #S108445155	TOTAL (YES)
AIR EMISSIONS Permitted air emissions (AIRS)	NO	NO	NO	0
Reported emergency releases to air (ERNS/A)	NO	NO	NO	0
Compliance data (AIRS/COM)	NO	NO	NO	0
WATER DISCHARGES Permitted waste water discharges (NPDES/PCS)	NO	NO	NO	0
Reported emergency releases to water (ERNS/W)	NO	NO	NO	0
Enforcement actions (NPDES/PCS-ENF)	NO	NO	NO	0
Inactive waste water discharges (NPDES-PCS INACT)	NO	NO	NO	0
Stormwater permit (STORMWATER)	NO	NO	NO	0
WASTE MANAGEMENT Generates hazardous waste (RCRA)	NO	NO	NO	0
Treats, stores, or disposes of hazardous waste on-site (RCRA/TSDF)	NO	NO	NO	0
Received Notices of Violations (RCRA/VIOL)	NO	NO	NO	0
Subject to RCRA administrative actions (RAATS)	NO	NO	NO	0
Subject to corrective actions (CORRACTS)	NO	NO	NO	0
Handles PCBs (PADS)	NO	NO	NO	0
Uses radioactive materials (MLTS)	NO	NO	NO	0
Uses FUSRAP	NO	NO	NO	0
Manages registered aboveground storage tanks(AST)	NO	NO	NO	0
Manages registered underground storage tanks(UST)	NO	NO	NO	0
Leaking underground storage tank incidents (LUST)	NO	NO	NO	0
Emergency releases to the soil (ERNS)	NO	NO	NO	0
Hazardous material incidents to DOT (HMIRS)	NO	NO	NO	0
WASTE DISPOSAL Superfund Site (NPL)	NO	NO	NO	0
Record of Decision (ROD)	NO	NO	NO	0
A known or suspect abandoned, inactive or uncontrolled hazardous waste site (CERCLIS)	NO	NO	NO	0
Superfund Lien (LIENS)	NO	NO	NO	0
State hazardous waste site (SHWS)	NO	NO	NO	0
Disposed of solid waste on-site (SWF/LF)	NO	NO	NO	0
MULTIMEDIA Uses toxic chemicals and has notified EPA under SARA Title III, Section 313 (TRIS)	NO	NO	NO	0
Produces pesticides and has notified EPA under Section 7 of FIFRA (SSTS)	NO	NO	NO	0
Manufactures or imports toxic chemicals on the TSCA list (TSCA)	NO	NO	NO	0
Inspections under FIFRA, TSCA or EPCRA (FTTS)	NO	NO	NO	0
Risk Management Plans database (RMP)	NO	NO	NO	0
Listed in EPA's index system (FINDS)	**YES - p6**	NO	NO	1
Listed in other database records (OTHER)	NO	NO	**YES - p12**	1
HEALTH AND SAFETY Inspected by the Occupational Safety and Health Administration (OSHA)	NO	NO	NO	0
Violations under OSHA (OSHA/VIOL)	NO	NO	NO	0
Facility has had accidents according to the Occupational Safety and Health Administration (OSHA/ACC)	NO	NO	NO	0
TOTAL (YES)	1	0	1	2

- A "NO" indicates that no findings were identified based on an exact name, address and/or EPA facility identification number search. Facility information may be available under an alternate name, address and/or EPA identification number.

SECTION 2: FACILITY DETAIL REPORTS

Record 1: EL DORADO CHEMICAL CO WHITEWRIGHT PLANT
WHITEWRIGHT, TX 75491 - 3012 (EDR ID# 1011325891)

AIR EMISSIONS

Facility has permitted air emissions . . . . NO

Facility has reported emergency releases to air. . . . . NO

Facility has compliance data . . . . NO

WATER DISCHARGES

Facility has permitted waste water discharges. . . . . NO

Facility has reported emergency releases to water. . . . . NO

Facility has enforcement actions . . . . NO

Facility has an inactive waste water permit. . . . . NO

Facility has stormwater discharges . . . . NO

WASTE MANAGEMENT

Facility generates hazardous waste . . . . NO

Facility treats, stores, or disposes of hazardous waste on-site. . . . . NO

Facility has received Notices of Violations . . . . NO

Facility has been subject to RCRA administrative actions . . . . NO

Facility has been subject to corrective actions. . . . . NO

Facility handles PCBs. . . . . NO

Facility uses radioactive materials. . . . . NO

Facility is a FUSRAP site (FUSRAP) . . . . NO

Facility manages registered aboveground storage tank incidents. . . . . NO

Facility manages registered underground storage tank incidents. . . . . NO

Facility has reported leaking underground storage tank incidents . . . . NO

Facility has reported emergency releases on land . . . . NO

Facility has reported hazardous material incidents to DOT. . . . . NO

WASTE DISPOSAL

Facility is a Superfund site . . . . NO

Facility has a Record of Decision on it. . . . . NO

Facility has a known or suspect abandoned, inactive, or uncontrolled hazardous waste site . . . . NO

Facility has a reported Superfund Lien on it. . . . . NO

Facility is listed as a state hazardous waste site. . . . . NO

Facility has disposed of solid waste on site . . . . NO

MULTI-MEDIA

Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313. . . . . NO

Facility produces pesticides and has notified EPA under Section 7 of FIFRA . . . . NO

Facility manufactures or imports toxic chemicals on the TSCA list. . . . . NO

Facility has inspections under FIFRA, TSCA or EPCRA . . . . NO

Facility is listed in EPA's index system. . . . . YES

Facility is in the Risk Managment Plans database. . . . . NO

Facility is listed in other database records. . . . . NO

HEALTH AND SAFETY

Facility has been inspected by the Occupational Safety and Health Administration . . . . NO

Facility has violations cited by the Occupational Safety and Health Administration. . . . . NO

Facility has had accidents according to the Occupational Safety and Health Administration. . . . . NO

TOTALS (YES) **1**

MULTIMEDIA

Facility is listed in EPA's index system

DATABASE: Facility Index System (FINDS)

EL DORADO CHEMICAL CO WHITEWRIGHT PLANT
1102 S BOND ST
WHITEWRIGHT, TX 75491 - 3012
EDR ID #1011325891

This site is listed in the Federal FINDS database. The FINDS database may contain references to records from government databases included elsewhere in the report.
Please note: the FINDS database may also contain references to out of date records formerly associated with the site.

Registry ID:	110034317102
Facility Name:	EL DORADO CHEMICAL CO WHITEWRIGHT PLANT
Facility Address:	1102 S BOND ST WHITEWRIGHT, TX 754913012
Facility URL:	http://iaspub.epa.gov/enviro/fii_query_detail.disp_program_facility?p_registry_id=110034317102
FIPS:	48181
Fed Facility:	Not reported
Tribal Land:	Not reported
Tribal Name:	Not reported
Congressional District:	04
Hydrologic Unit Code:	11140101
EPA Region:	06
Site Type:	STATIONARY
Date Created:	17-APR-08
Date Updated:	11-AUG-10
U.S-Mexico Border:	Not reported
Latitude:	33.502185
Longitude:	-96.393827
Horizontal Collection:	ADDRESS MATCHING-HOUSE NUMBER
Horizontal Accuracy:	150
Reference Point:	ENTRANCE POINT OF A FACILITY OR STATION
Horizontal Datum:	NAD83
Coordinates Source:	Not reported

Environmental Interest/Information System

Texas Commission on Environmental Quality - Agency Central Registry (TX-TCEQ ACR) is a computer application that allows the Texas Commission on Environmental Quality (TCEQ) to use a single, centralized area to record common information, such as the company names, addresses, and telephone numbers of those the TCEQ regulates. It also contains additional IDs (permits, registrations, authorizations, etc) and their status.

Program System ID:	RN103032868
Program Sys. Name:	TX-TCEQ ACR
Env. Interest Type:	STATE MASTER
Env. Interest Start Dt.:	Not reported
Start Date Qualifier:	Not reported
Env. Interest End Dt.:	Not reported
End Date Qualifier:	Not reported
Data Source:	TX-TCEQ ACR
Active Code:	Not reported

Alternative Name: EL DORADO CHEMICAL CO WHITEWRIGHT PLANT

SIC Code: 2875(FERTILIZERS, MIXING ONLY)

Organization Name:	EL DORADO CHEMICAL COMPANY
Affiliation Type:	OWNER OPERATOR
Organization Type:	CORPORATI
DUNS Number:	Not reported
Division Name:	Not reported
Telephone Number:	9727221113
Alternative Number:	Not reported
Fax Number:	Not reported
Email:	Not reported
EIN:	731183488
State Business ID:	17311834885
Parent Name:	Not reported
Parent DUNS:	Not reported
Mailing Address:	1950 ALPHA DR ROCKWALL, TX 750874928

Organization Name:	EL DORADO CHEMICAL COMPANY
Affiliation Type:	BILLING
Organization Type:	CORPORATI
DUNS Number:	Not reported
Division Name:	Not reported

Telephone Number:	9727221113
Alternative Number:	Not reported
Fax Number:	Not reported
Email:	Not reported
EIN:	731183488
State Business ID:	17311834885
Parent Name:	Not reported
Parent DUNS:	Not reported
Mailing Address:	1950 ALPHA DR ROCKWALL, TX 750874928

Supplemental Interest:	STATE MASTER
PGM Sys ID:	PERMIT
Supplemental PGM Sys ID:	TXR05O755
Start Date:	06-DEC-01
Start Date Qualifier:	Not reported
End Date:	Not reported
End Date Qualifier:	Not reported
Date Source:	TX-TCEQ ACR
Last Reported:	Not reported
Date Created:	17-APR-08
Date Updated:	Not reported

Supplemental Interest:	STATE MASTER
PGM Sys ID:	SOLID WASTE REGISTRA
Supplemental PGM Sys ID:	T2449
Start Date:	Not reported
Start Date Qualifier:	Not reported
End Date:	Not reported
End Date Qualifier:	Not reported
Date Source:	TX-TCEQ ACR
Last Reported:	Not reported
Date Created:	12-AUG-10
Date Updated:	Not reported

Record 2: EL DORADO CHEMICAL WHITEWRIGHT PLANT
WHITEWRIGHT, TX 75491 (EDR ID# S113417076)

AIR EMISSIONS
Facility has permitted air emissions .... NO

Facility has reported emergency releases to air. .... NO

Facility has compliance data .... NO

WATER DISCHARGES
Facility has permitted waste water discharges. .... NO

Facility has reported emergency releases to water. .... NO

Facility has enforcement actions .... NO

Facility has an inactive waste water permit. .... NO

Facility has stormwater discharges .... NO

WASTE MANAGEMENT
Facility generates hazardous waste .... NO

Facility treats, stores, or disposes of hazardous waste on-site. .... NO

Facility has received Notices of Violations .... NO

Facility has been subject to RCRA administrative actions .... NO

Facility has been subject to corrective actions. .... NO

Facility handles PCBs. .... NO

Facility uses radioactive materials. .... NO

Facility is a FUSRAP site (FUSRAP) .... NO

Facility manages registered aboveground storage tank incidents. .... NO

Facility manages registered underground storage tank incidents. .... NO

Facility has reported leaking underground storage tank incidents .... NO

Facility has reported emergency releases on land .... NO

Facility has reported hazardous material incidents to DOT. .... NO

WASTE DISPOSAL
Facility is a Superfund site .... NO

Facility has a Record of Decision on it. .... NO

Facility has a known or suspect abandoned, inactive, or uncontrolled hazardous waste site .... NO

Facility has a reported Superfund Lien on it. .... NO

Facility is listed as a state hazardous waste site. .... NO

Facility has disposed of solid waste on site .... NO

MULTI-MEDIA
Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313. .... NO

Facility produces pesticides and has notified EPA under Section 7 of FIFRA .... NO

Facility manufactures or imports toxic chemicals on the TSCA list. .... NO

Facility has inspections under FIFRA, TSCA or EPCRA .... NO

Facility is listed in EPA's index system. .... NO

Facility is in the Risk Managment Plans database. .... NO

Facility is listed in other database records. .... NO

HEALTH AND SAFETY
Facility has been inspected by the Occupational Safety and Health Administration .... NO

Facility has violations cited by the Occupational Safety and Health Administration. .... NO

Facility has had accidents according to the Occupational Safety and Health Administration. .... NO

TOTALS (YES) 0

SECTION 2: FACILITY DETAIL REPORTS

...Continued...

Record 3: EL DORADO CHEMICAL COMPANY
WHITEWRIGHT, TX 75491 (EDR ID# S108445155)

AIR EMISSIONS

Facility has permitted air emissions .... NO

Facility has reported emergency releases to air........ NO

Facility has compliance data .... NO

WATER DISCHARGES

Facility has permitted waste water discharges........ NO

Facility has reported emergency releases to water........ NO

Facility has enforcement actions .... NO

Facility has an inactive waste water permit........ NO

Facility has stormwater discharges .... NO

WASTE MANAGEMENT

Facility generates hazardous waste .... NO

Facility treats, stores, or disposes of hazardous waste on-site........ NO

Facility has received Notices of Violations .... NO

Facility has been subject to RCRA administrative actions .... NO

Facility has been subject to corrective actions........ NO

Facility handles PCBs........ NO

Facility uses radioactive materials........ NO

Facility is a FUSRAP site (FUSRAP) .... NO

Facility manages registered aboveground storage tank incidents........ NO

Facility manages registered underground storage tank incidents........ NO

Facility has reported leaking underground storage tank incidents .... NO

Facility has reported emergency releases on land .... NO

Facility has reported hazardous material incidents to DOT........ NO

WASTE DISPOSAL

Facility is a Superfund site .... NO

Facility has a Record of Decision on it........ NO

Facility has a known or suspect abandoned, inactive, or uncontrolled hazardous waste site .... NO

Facility has a reported Superfund Lien on it........ NO

Facility is listed as a state hazardous waste site........ NO

Facility has disposed of solid waste on site .... NO

MULTI-MEDIA

Facility uses toxic chemicals and has notified EPA under SARA Title III, Section 313........ NO

Facility produces pesticides and has notified EPA under Section 7 of FIFRA .... NO

Facility manufactures or imports toxic chemicals on the TSCA list........ NO

Facility has inspections under FIFRA, TSCA or EPCRA .... NO

Facility is listed in EPA's index system........ NO

Facility is in the Risk Managment Plans database........ NO

Facility is listed in other database records........ YES

HEALTH AND SAFETY

Facility has been inspected by the Occupational Safety and Health Administration .... NO

Facility has violations cited by the Occupational Safety and Health Administration........ NO

Facility has had accidents according to the Occupational Safety and Health Administration........ NO

TOTALS (YES) 1

SECTION 2: FACILITY DETAIL REPORTS

...Continued...

MULTIMEDIA

Facility is listed in other database records

DATABASE: Other Database Records (OTHER)

EL DORADO CHEMICAL COMPANY
1102 SOUTH BOND STREET
WHITEWRIGHT, TX 75491
EDR ID #S108445155

GCC:

Division:	RMD/CA
New Cases:	*
File Number:	T2449
Contamination Description:	NITRATE, ALPHA BHC, DICAMBA, ARSENIC
Date Of Earliest Known Contamination Confirmation:	4/16/2010
Enforcement Status - Level Of Agency Response:	0B
Enforcement Status - Site Activity Status:	1A, 2A, 3
Data Quality 1:	E,Q
Section 5236:	Not reported
Type:	GROUNDWATER CONTAMINATION CASE DESCRIPTION BY COUNTY TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Agency:	Not reported
Section:	Not reported
Year Deleted:	Not reported
Location:	Not reported
Data Quality 2:	Not reported

Division:	RMD/CA
New Cases:	*
File Number:	T2449
Contamination Description:	NITRATE, ALPHA BHC, DICAMBA, ARSENIC
Date Of Earliest Known Contamination Confirmation:	4/16/2010
Enforcement Status - Level Of Agency Response:	0B
Enforcement Status - Site Activity Status:	1A, 2A, 3
Data Quality 1:	E,Q
Section 5236:	Not reported
Type:	GROUNDWATER CONTAMINATION CASE DESCRIPTION BY COUNTY TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Agency:	Not reported
Section:	Not reported
Year Deleted:	Not reported
Location:	Not reported
Data Quality 2:	Not reported

Division:	REM/CA
New Cases:	Not reported
File Number:	T2449
Contamination Description:	NITRATE, ALPHA BHC, DICAMBA, ARSENIC
Date Of Earliest Known Contamination Confirmation:	4/16/2010
Enforcement Status - Level Of Agency Response:	0B
Enforcement Status - Site Activity Status:	1A, 2A, 3
Data Quality 1:	E,Q
Section 5236:	Not reported
Type:	GROUNDWATER CONTAMINATION CASE DESCRIPTION BY COUNTY TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Agency:	Not reported
Section:	Not reported
Year Deleted:	Not reported
Location:	Not reported
Data Quality 2:	Not reported

Division:	REM/CA
New Cases:	Not reported
File Number:	T2449
Contamination Description:	NITRATE, ALPHA BHC, DICAMBA, ARSENIC
Date Of Earliest Known Contamination Confirmation:	4/16/2010
Enforcement Status - Level Of Agency Response:	0B
Enforcement Status - Site Activity Status:	1A, 2A, 3
Data Quality 1:	E,Q
Section 5236:	Not reported
Type:	GROUNDWATER CONTAMINATION CASE DESCRIPTION BY COUNTY TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Agency:	Not reported
Section:	Not reported
Year Deleted:	Not reported
Location:	Not reported
Data Quality 2:	Not reported

TIER 2:

Facility Id/Name:	FATR20124604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2012
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	5/8/2013
Date Tier 2 Signed:	1-15-2013
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	True
State Fees Total:	Not reported
Number Of Employess On Site:	4
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported

Facility Id/Name:	FATR20114604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2011
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	5/16/2012
Date Tier 2 Signed:	2/02/2012
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	4
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported

Facility Id/Name:	FATR20104604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2010
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	6/1/2011
Date Tier 2 Signed:	01/19/2011
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	5
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported

Fire District:	Not reported
Additional Mail Addr:	Not reported

Facility Id/Name:	FATR20094604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2009
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	5/24/2010
Date Tier 2 Signed:	02/04/2010
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	5
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported

Facility Id/Name:	FATR20084604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2008
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	6/30/2009
Date Tier 2 Signed:	01/29/2009
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	5
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported

Facility Id/Name:	FATR20074604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2007
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	8/5/2008
Date Tier 2 Signed:	2/13/2008
Mailing Address:	P.O. Box 828
Mailing City/State/Country:	Whitewright, TX USA
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	Not reported
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Connie Brumlow, Reg. Compliance Mgr.
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported

Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported
Facility Id/Name:	FATR20054604V700L8VK/EL DORADO CHEMICAL COMPANY
Reporting Year:	2005
Facility Country:	USA
Facility Department:	Not reported
Facility Date Modified:	2/27/2007
Date Tier 2 Signed:	2/6/2006
Mailing Address:	Not reported
Mailing City/State/Country:	Not reported
Dikes/Other Safeguard Meas Emp:	Not reported
All Chemicals Same As Last Year:	Not reported
State Fees Total:	Not reported
Number Of Employess On Site:	Not reported
Site Map:	Not reported
Fire District:	Not reported
Submitted By:	Roger N. Cotman
Latitude:	Not reported
Longitude:	Not reported
Lat/Long Location Desc:	Not reported
Lat/Long Method:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Number Of Emp. Required:	Not reported
Fail Valid:	Not reported
Site Coordinate Abbr Submitted:	Not reported
Mail Address:	Not reported
Mail City:	Not reported
Mail State Req.:	Not reported
Fire District:	Not reported
Additional Mail Addr:	Not reported
Notes:	Not reported
Validation:	Not reported

Facility Info:

Id:	2875
Id Type:	SIC
Description:	FERTILIZERS, MIXING ONLY
Last Modified:	1/5/2006
Id:	325314
Id Type:	NAICS
Description:	Fertilizer (Mixing Only) Manufacturing
Last Modified:	01/29/2009
Id:	103970307
Id Type:	Dun & Bradstreet
Description:	Not reported
Last Modified:	1/5/2006

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Larry Riddle
Title:	Safety-Operations Manager
Modification Date:	4/26/2013

Contact:

Contact Email:	cbrumlow@lsb-okc.com
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Connie Brumlow
Title:	Compliance Manager
Modification Date:	4/26/2013

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243

Contact Mail Country:	USA
Contact Type 1:	Owner / Operator
Contact Name:	EL Dorado Chemical Company
Title:	Not reported
Modification Date:	4/26/2013

Contact:

Contact Email:	Not reported
Contact Mail Address:	1102 South Bond Street
Contact City/State/Zip:	Whitewright, TX 75491
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Name:	Gary Wrede
Title:	Plant Manager
Modification Date:	2/23/2013

Chemical Inventory:

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Ammonium Nitrate
Chemical Inv Record Id:	CVTR2012460GR9007RJH
CAS Number:	6484-52-2
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	T
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2012475V86010GRJ
Chemical Inventory Record Id:	CVTR2012460GR9007RJH
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/23/2013

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Potassium Chloride
Chemical Inv Record Id:	CVTR2012475TAA009H4P
CAS Number:	7447-40-7
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2012475TCU00ANSV

Chemical Inventory Record Id: CVTR2012475TAA009H4P
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/23/2013

Facility Id: FATR20124604V700L8VK
Chemical Name: Potassium Magnesium Sulfate
Chemical Inv Record Id: CVTR2012475V9F011KYW
CAS Number: Not reported
Chemical Same As Last Year: T
Acute Health Risks: T
Average Daily Amount: 10,000 - 99,999 pounds
Max Daily Amount: 100,000 - 999,999 pounds
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/23/2013
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2012
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR2012475VC6012Y7T
Chemical Inventory Record Id: CVTR2012475V9F011KYW
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/23/2013

Facility Id: FATR20124604V700L8VK
Chemical Name: Ammonium Phosphate Dibasic
Chemical Inv Record Id: CVTR201247PSNE00JY4N
CAS Number: 7783-28-0
Chemical Same As Last Year: Not reported
Acute Health Risks: T
Average Daily Amount: 10,000 - 99,999 pounds
Max Daily Amount: 100,000 - 999,999 pounds
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/23/2013
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2012
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR201247PSQ400KDVX
Chemical Inventory Record Id: CVTR201247PSNE00JY4N
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/23/2013

Facility Id: FATR20124604V700L8VK

Chemical Name:	Coastal Bermuda Grass Special
Chemical Inv Record Id:	CVTR201247U9XL001WEY
CAS Number:	Not reported
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201247U9ZJ002KT3
Chemical Inventory Record Id:	CVTR201247U9XL001WEY
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Warehouse Building
Last Modified:	2/23/2013

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Calcium Carbonate
Chemical Inv Record Id:	CVTR201247VZCG01Q9W8
CAS Number:	1317-65-3
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	0 - 99 pounds
Max Daily Amount:	10,000 - 99,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201247VZE001RM9B
Chemical Inventory Record Id:	CVTR201247VZCG01Q9W8
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Warehouse
Last Modified:	2/23/2013

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Ammonium Phosphates
Chemical Inv Record Id:	CVTR201270ELKN01V2ZD
CAS Number:	Not reported
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported

Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201270ELMH01WPMU
Chemical Inventory Record Id:	CVTR201270ELKN01V2ZD
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/23/2013

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Manganese Oxide & Manganese Sulfate
Chemical Inv Record Id:	CVTR201270ELN301X6DP
CAS Number:	1344-43-0
Chemical Same As Last Year:	Not reported
Acute Health Risks:	Not reported
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201270ELP001YZM8
Chemical Inventory Record Id:	CVTR201270ELN301X6DP
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/23/2013

Facility Id:	FATR20124604V700L8VK
Chemical Name:	Monoammonium Phosphate
Chemical Inv Record Id:	CVTR20127NZ6D500KF7K
CAS Number:	7722-76-1
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100 - 999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/23/2013
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T

Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2012
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR20127NZ6FD00LD8H
Chemical Inventory Record Id:	CVTR20127NZ6D500KF7K
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/23/2013

Notes:	Not reported
Validation:	Not reported

Facility Info:

Id:	103970307
Id Type:	Dun & Bradstreet
Description:	Not reported
Last Modified:	1/5/2006
Id:	2875
Id Type:	SIC
Description:	FERTILIZERS, MIXING ONLY
Last Modified:	1/5/2006
Id:	325314
Id Type:	NAICS
Description:	Fertilizer (Mixing Only) Manufacturing
Last Modified:	01/29/2009

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Larry Riddle
Title:	Safety-Operations Manager
Modification Date:	2/12/2010

Contact:

Contact Email:	Not reported
Contact Mail Address:	1102 South Bond Street
Contact City/State/Zip:	Whitewright, TX 75491
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Name:	Rodney Bowers
Title:	Plant Manager
Modification Date:	2/12/2010

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Owner / Operator
Contact Name:	EL Dorado Chemical Company
Title:	Not reported
Modification Date:	2/12/2010

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Connie Brumlow
Title:	Compliance Manager
Modification Date:	2/12/2010

Chemical Inventory:
Facility Id: FATR20094604V700L8VK
Chemical Name: Ammonium Nitrate
Chemical Inv Record Id: CVTR2009460GR9007RJH
CAS Number: 6484-52-2
Chemical Same As Last Year: T
Acute Health Risks: T
Average Daily Amount: 5
Max Daily Amount: 6
Max Amount In Largest Container: Not reported
Chronic Health Risks: T
EHS Substance: Not reported
Last Modified: 2/12/2010
Days On Site: 365
Fire Hazard: T
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2009
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR2009475V86010GRJ
Chemical Inventory Record Id: CVTR2009460GR9007RJH
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/12/2010

Facility Id: FATR20094604V700L8VK
Chemical Name: Potassium Chloride
Chemical Inv Record Id: CVTR2009475TAA009H4P
CAS Number: 7447-40-7
Chemical Same As Last Year: T
Acute Health Risks: T
Average Daily Amount: 5
Max Daily Amount: 5
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/12/2010
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2009
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR2009475TCU00ANSV
Chemical Inventory Record Id: CVTR2009475TAA009H4P
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/12/2010

Facility Id: FATR20094604V700L8VK
Chemical Name: Potassium Magnesium Sulfate
Chemical Inv Record Id: CVTR2009475V9F011KYW
CAS Number: Not reported
Chemical Same As Last Year: T
Acute Health Risks: T
Average Daily Amount: 4
Max Daily Amount: 5
Max Amount In Largest Container: Not reported

Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/12/2010
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2009
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2009475VC6012Y7T
Chemical Inventory Record Id:	CVTR2009475V9F011KYW
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/12/2010

Facility Id:	FATR20094604V700L8VK
Chemical Name:	Ammonium Phosphate Dibasic
Chemical Inv Record Id:	CVTR200947PSNE00JY4N
CAS Number:	7783-28-0
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	5
Max Daily Amount:	5
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/12/2010
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2009
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR200947PSQ400KDVX
Chemical Inventory Record Id:	CVTR200947PSNE00JY4N
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/12/2010

Facility Id:	FATR20094604V700L8VK
Chemical Name:	TRADE SECRET
Chemical Inv Record Id:	CVTR200947U9XL001WEY
CAS Number:	TRADE SECRET
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	3
Max Daily Amount:	3
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/12/2010
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported

Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	T
Contact Label:	Not reported
Label Code:	TX2009
Trade Secret:	T

Chemical Inventory Location:

Record Key:	CLTR200947U9ZJ002KT3
Chemical Inventory Record Id:	CVTR200947U9XL001WEY
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Warehouse Building
Last Modified:	2/12/2010

Facility Id:	FATR20094604V700L8VK
Chemical Name:	Calcium Carbonate
Chemical Inv Record Id:	CVTR200947VZCG01Q9W8
CAS Number:	1317-65-3
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	1
Max Daily Amount:	4
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/12/2010
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2009
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR200947VZE001RM9B
Chemical Inventory Record Id:	CVTR200947VZCG01Q9W8
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Warehouse
Last Modified:	2/12/2010

Facility Id:	FATR20094604V700L8VK
Chemical Name:	Ammonium Phosphates
Chemical Inv Record Id:	CVTR200970ELKN01V2ZD
CAS Number:	Not reported
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	5
Max Daily Amount:	5
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/12/2010
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2009
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR200970ELMH01WPMU

Chemical Inventory Record Id: CVTR200970ELKN01V2ZD
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/12/2010

Facility Id: FATR20094604V700L8VK
Chemical Name: Manganese Oxide & Manganese Sulfate
Chemical Inv Record Id: CVTR200970ELN301X6DP
CAS Number: 1344-43-0
Chemical Same As Last Year: Not reported
Acute Health Risks: Not reported
Average Daily Amount: 3
Max Daily Amount: 3
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/12/2010
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: T
Sudden Release Of Pressure Haz: Not reported
Pure Form: Not reported
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2009
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR200970ELP001YZM8
Chemical Inventory Record Id: CVTR200970ELN301X6DP
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Bag
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/12/2010

Notes: Not reported

Validation: This facility passed all validation checks.

Notes: Not reported

Validation: Not reported

Facility Info:
Id: 2875
Id Type: SIC
Description: FERTILIZERS, MIXING ONLY
Last Modified: 1/5/2006
Id: 103970307
Id Type: Dun & Bradstreet
Description: Not reported
Last Modified: 1/5/2006
Id: 325314
Id Type: NAICS
Description: Fertilizer (Mixing Only) Manufacturing
Last Modified: 01/29/2009

Contact:
Contact Email: Not reported
Contact Mail Address: 1309 Ridge Road, Suite 315
Contact City/State/Zip: Rockwall, TX 75087-4243
Contact Mail Country: USA
Contact Type 1: Emergency Contact
Contact Type 2: Regulatory Point of Contact
Contact Name: Larry Riddle
Title: Safety-Operations Manager
Modification Date: 2/6/2012

Contact:	
Contact Email:	cbrumlow@lsb-okc.com
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Connie Brumlow
Title:	Compliance Manager
Modification Date:	2/6/2012

Contact:	
Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Owner / Operator
Contact Name:	EL Dorado Chemical Company
Title:	Not reported
Modification Date:	2/6/2012

Contact:	
Contact Email:	Not reported
Contact Mail Address:	1102 South Bond Street
Contact City/State/Zip:	Whitewright, TX 75491
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Name:	Gary Wrede
Title:	Plant Manager
Modification Date:	2/6/2012

Chemical Inventory:	
Facility Id:	FATR20114604V700L8VK
Chemical Name:	Ammonium Nitrate
Chemical Inv Record Id:	CVTR2011460GR9007RJH
CAS Number:	6484-52-2
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	T
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:	
Record Key:	CLTR2011475V86010GRJ
Chemical Inventory Record Id:	CVTR2011460GR9007RJH
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Potassium Chloride
Chemical Inv Record Id:	CVTR2011475TAA009H4P
CAS Number:	7447-40-7
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported

Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2011475TCU00ANSV
Chemical Inventory Record Id:	CVTR2011475TAA009H4P
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Potassium Magnesium Sulfate
Chemical Inv Record Id:	CVTR2011475V9F011KYW
CAS Number:	Not reported
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2011475VC6012Y7T
Chemical Inventory Record Id:	CVTR2011475V9F011KYW
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Ammonium Phosphate Dibasic
Chemical Inv Record Id:	CVTR201147PSNE00JY4N
CAS Number:	7783-28-0
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T

Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201147PSQ400KDVX
Chemical Inventory Record Id:	CVTR201147PSNE00JY4N
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Coastal Bermuda Grass Special
Chemical Inv Record Id:	CVTR201147U9XL001WEY
CAS Number:	Not reported
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201147U9ZJ002KT3
Chemical Inventory Record Id:	CVTR201147U9XL001WEY
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Warehouse Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Calcium Carbonate
Chemical Inv Record Id:	CVTR201147VZCG01Q9W8
CAS Number:	1317-65-3
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	0 - 99 pounds
Max Daily Amount:	10,000 - 99,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201147VZE001RM9B

Chemical Inventory Record Id:	CVTR201147VZCG01Q9W8
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Warehouse
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Ammonium Phosphates
Chemical Inv Record Id:	CVTR201170ELKN01V2ZD
CAS Number:	Not reported
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201170ELMH01WPMU
Chemical Inventory Record Id:	CVTR201170ELKN01V2ZD
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK
Chemical Name:	Manganese Oxide & Manganese Sulfate
Chemical Inv Record Id:	CVTR201170ELN301X6DP
CAS Number:	1344-43-0
Chemical Same As Last Year:	Not reported
Acute Health Risks:	Not reported
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201170ELP001YZM8
Chemical Inventory Record Id:	CVTR201170ELN301X6DP
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012

Facility Id:	FATR20114604V700L8VK

Chemical Name:	Monoammonium Phosphate
Chemical Inv Record Id:	CVTR20117NZ6D500KF7K
CAS Number:	7722-76-1
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100 - 999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/6/2012
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2011
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR20117NZ6FD00LD8H
Chemical Inventory Record Id:	CVTR20117NZ6D500KF7K
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/6/2012
Notes:	Not reported
Validation:	Not reported

Facility Info:

Id:	2875
Id Type:	SIC
Description:	FERTILIZERS, MIXING ONLY
Last Modified:	1/5/2006
Id:	103970307
Id Type:	Dun & Bradstreet
Description:	Not reported
Last Modified:	1/5/2006
Id:	325314
Id Type:	NAICS
Description:	Fertilizer (Mixing Only) Manufacturing
Last Modified:	01/29/2009

Contact:

Contact Email:	Not reported
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Larry Riddle
Title:	Safety-Operations Manager
Modification Date:	2/16/2011

Contact:

Contact Email:	cbrumlow@lsb-okc.com
Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Type 2:	Regulatory Point of Contact
Contact Name:	Connie Brumlow
Title:	Compliance Manager
Modification Date:	2/16/2011

Contact:

Contact Email:	Not reported

Contact Mail Address:	1309 Ridge Road, Suite 315
Contact City/State/Zip:	Rockwall, TX 75087-4243
Contact Mail Country:	USA
Contact Type 1:	Owner / Operator
Contact Name:	EL Dorado Chemical Company
Title:	Not reported
Modification Date:	2/16/2011

Contact:

Contact Email:	Not reported
Contact Mail Address:	1102 South Bond Street
Contact City/State/Zip:	Whitewright, TX 75491
Contact Mail Country:	USA
Contact Type 1:	Emergency Contact
Contact Name:	Rodney Bowers
Title:	Plant Manager
Modification Date:	2/16/2011

Chemical Inventory:

Facility Id:	FATR20104604V700L8VK
Chemical Name:	Ammonium Nitrate
Chemical Inv Record Id:	CVTR2010460GR9007RJH
CAS Number:	6484-52-2
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	T
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR2010475V86010GRJ
Chemical Inventory Record Id:	CVTR2010460GR9007RJH
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/16/2011

Facility Id:	FATR20104604V700L8VK
Chemical Name:	Potassium Chloride
Chemical Inv Record Id:	CVTR2010475TAA009H4P
CAS Number:	7447-40-7
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:
Record Key: CLTR2010475TCU00ANSV
Chemical Inventory Record Id: CVTR2010475TAA009H4P
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/16/2011

Facility Id: FATR20104604V700L8VK
Chemical Name: Potassium Magnesium Sulfate
Chemical Inv Record Id: CVTR2010475V9F011KYW
CAS Number: Not reported
Chemical Same As Last Year: T
Acute Health Risks: T
Average Daily Amount: 10,000 - 99,999 pounds
Max Daily Amount: 100,000 - 999,999 pounds
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/16/2011
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2010
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR2010475VC6012Y7T
Chemical Inventory Record Id: CVTR2010475V9F011KYW
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building
Last Modified: 2/16/2011

Facility Id: FATR20104604V700L8VK
Chemical Name: Ammonium Phosphate Dibasic
Chemical Inv Record Id: CVTR201047PSNE00JY4N
CAS Number: 7783-28-0
Chemical Same As Last Year: Not reported
Acute Health Risks: T
Average Daily Amount: 10,000 - 99,999 pounds
Max Daily Amount: 100,000 - 999,999 pounds
Max Amount In Largest Container: Not reported
Chronic Health Risks: Not reported
EHS Substance: Not reported
Last Modified: 2/16/2011
Days On Site: 365
Fire Hazard: Not reported
Gas: Not reported
Liquid: Not reported
Mixture Form: Not reported
Sudden Release Of Pressure Haz: Not reported
Pure Form: T
Reactive Hazard: Not reported
Solid: T
Trade Secret: Not reported
Contact Label: Not reported
Label Code: TX2010
Trade Secret: Not reported

Chemical Inventory Location:
Record Key: CLTR201047PSQ400KDVX
Chemical Inventory Record Id: CVTR201047PSNE00JY4N
Amt Of Sub Stored Or Transported: Not reported
Amount Units: pounds
Type Of Storage: Other
Number Code/Storage Pressure: 1
Number Code/Storage Temperature: 4
Desc of Loc(Or Transported) Subs: Bulk Storage Building

Last Modified:	2/16/2011
Facility Id:	FATR20104604V700L8VK
Chemical Name:	Coastal Bermuda Grass Special
Chemical Inv Record Id:	CVTR201047U9XL001WEY
CAS Number:	Not reported
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	T
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	T

Chemical Inventory Location:

Record Key:	CLTR201047U9ZJ002KT3
Chemical Inventory Record Id:	CVTR201047U9XL001WEY
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Warehouse Building
Last Modified:	2/16/2011
Facility Id:	FATR20104604V700L8VK
Chemical Name:	Calcium Carbonate
Chemical Inv Record Id:	CVTR201047VZCG01Q9W8
CAS Number:	1317-65-3
Chemical Same As Last Year:	T
Acute Health Risks:	T
Average Daily Amount:	0 - 99 pounds
Max Daily Amount:	10,000 - 99,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201047VZE001RM9B
Chemical Inventory Record Id:	CVTR201047VZCG01Q9W8
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Warehouse
Last Modified:	2/16/2011
Facility Id:	FATR20104604V700L8VK
Chemical Name:	Ammonium Phosphates
Chemical Inv Record Id:	CVTR201070ELKN01V2ZD
CAS Number:	Not reported
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	100,000 - 999,999 pounds
Max Daily Amount:	100,000 - 999,999 pounds

Max Amount In Largest Container:	Not reported
Chronic Health Risks:	T
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201070ELMH01WPMU
Chemical Inventory Record Id:	CVTR201070ELKN01V2ZD
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/16/2011

Facility Id:	FATR20104604V700L8VK
Chemical Name:	Manganese Oxide & Manganese Sulfate
Chemical Inv Record Id:	CVTR201070ELN301X6DP
CAS Number:	1344-43-0
Chemical Same As Last Year:	Not reported
Acute Health Risks:	Not reported
Average Daily Amount:	1,000 - 9,999 pounds
Max Daily Amount:	1,000 - 9,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	T
Sudden Release Of Pressure Haz:	Not reported
Pure Form:	Not reported
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR201070ELP001YZM8
Chemical Inventory Record Id:	CVTR201070ELN301X6DP
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Bag
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/16/2011

Facility Id:	FATR20104604V700L8VK
Chemical Name:	Monoammonium Phosphate
Chemical Inv Record Id:	CVTR20107NZ6D500KF7K
CAS Number:	7722-76-1
Chemical Same As Last Year:	Not reported
Acute Health Risks:	T
Average Daily Amount:	10,000 - 99,999 pounds
Max Daily Amount:	10,000 - 99,999 pounds
Max Amount In Largest Container:	Not reported
Chronic Health Risks:	Not reported
EHS Substance:	Not reported
Last Modified:	2/16/2011
Days On Site:	365
Fire Hazard:	Not reported
Gas:	Not reported
Liquid:	Not reported
Mixture Form:	Not reported
Sudden Release Of Pressure Haz:	Not reported

Pure Form:	T
Reactive Hazard:	Not reported
Solid:	T
Trade Secret:	Not reported
Contact Label:	Not reported
Label Code:	TX2010
Trade Secret:	Not reported

Chemical Inventory Location:

Record Key:	CLTR20107NZ6FD00LD8H
Chemical Inventory Record Id:	CVTR20107NZ6D500KF7K
Amt Of Sub Stored Or Transported:	Not reported
Amount Units:	pounds
Type Of Storage:	Other
Number Code/Storage Pressure:	1
Number Code/Storage Temperature:	4
Desc of Loc(Or Transported) Subs:	Bulk Storage Building
Last Modified:	2/16/2011

Notes:	Not reported
Validation:	Not reported

Notes:	Not reported
Validation:	This facility passed all validation checks.

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

To maintain currency of the following federal, state and local databases, EDR contacts the appropriate government agency on a monthly or quarterly basis as required.

Elapsed ASTM days: Provides confirmation that this report meets or exceeds the 90-day updating requirement of the ASTM standard.

FACILITY RELATED DATABASES

AIR EMISSIONS

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)
Source: EPA
Telephone: 202-564-2496
The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/16/2014
Database Release Frequency: Annually
Date of Last EDR Contact: 02/06/2015
Date of Next Scheduled Update: 04/13/2015

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/29/2014
Database Release Frequency: Annually
Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

WATER DISCHARGES

PCS: Permit Compliance System
Source: EPA, Office of Water
Telephone: 202-564-2496
PCS is a computerized management information system that contains data on National Pollutant Discharge Elimination System (NPDES) permit holding facilities. PCS tracks the permit, compliance, and enforcement status of NPDES facilities.

Date of Government Version: 07/14/2011
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 12/09/2015
Date of Next Scheduled Update: 06/29/2015

PCS: Permit Compliance System
Source: EPA, Office of Water
Telephone: 202-564-2496
PCS is a computerized management information system that contains data on National Pollutant Discharge Elimination System (NPDES) permit holding facilities. PCS tracks the permit, compliance, and enforcement status of NPDES facilities.

Date of Government Version: 07/14/2011
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 12/09/2015
Date of Next Scheduled Update: 06/29/2015

PCS INACTIVE: Listing of Inactive PCS Permits
Source: EPA
Telephone: 202-564-2496
An inactive permit is a facility that has shut down or is no longer discharging.

Date of Government Version: 07/29/2011
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 12/09/2014
Date of Next Scheduled Update: 04/27/2015

ERNS: Emergency Response Notification System

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/29/2014
Database Release Frequency: Annually

Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

WASTE MANAGEMENT

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

Source: Environmental Protection Agency
Telephone: 703-308-8895

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 12/09/2014
Database Release Frequency: Quarterly

Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

RCRA-LQG: RCRA - Large Quantity Generators

Source: Environmental Protection Agency
Telephone: 703-308-8895

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 12/09/2014
Database Release Frequency: Quarterly

Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

RCRA-SQG: RCRA - Small Quantity Generators

Source: Environmental Protection Agency
Telephone: 703-308-8895

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 12/09/2014
Database Release Frequency: Quarterly

Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generator

Source: Environmental Protection Agency
Telephone: 703-308-8895

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 12/09/2014
Database Release Frequency: Varies

Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated
Source: Environmental Protection Agency
Telephone: 703-308-8895
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 12/09/2014
Database Release Frequency: Varies
Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

BRS: Biennial Reporting System
Source: EPA/NTIS
Telephone: 800-424-9346
The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Database Release Frequency: Biennially
Date of Last EDR Contact: 02/24/2015
Date of Next Scheduled Update: 06/08/2015

RAATS: RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Database Release Frequency: No Update Planned
Date of Last EDR Contact: 06/02/2008
Date of Next Scheduled Update: 09/01/2008

CORRACTS: Corrective Action Report
Source: EPA
Telephone: 800-424-9346
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 12/09/2014
Database Release Frequency: Quarterly
Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

PADS: PCB Activity Database System
Source: EPA
Telephone: 202-566-0500
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/01/2014
Database Release Frequency: Annually
Date of Last EDR Contact: 01/16/2015
Date of Next Scheduled Update: 04/27/2015

MLTS: Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 12/29/2014
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/09/2015
Date of Next Scheduled Update: 06/22/2015

TX AST: Petroleum Storage Tank Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Registered Aboveground Storage Tanks.

Date of Government Version: 01/14/2015
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/12/2015
Date of Next Scheduled Update: 04/13/2015

TX UST: Petroleum Storage Tank Database
Source: Texas Commission on Environmental Quality
Telephone: 512-239-2160
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 01/14/2015
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/12/2015
Date of Next Scheduled Update: 04/13/2015

ERNS: Emergency Response Notification System
Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/29/2014
Database Release Frequency: Annually
Date of Last EDR Contact: 12/29/2014
Date of Next Scheduled Update: 04/13/2015

HMIRS: Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/29/2014
Database Release Frequency: Annually
Date of Last EDR Contact: 12/30/2014
Date of Next Scheduled Update: 04/13/2015

WASTE DISPOSAL

NPL: National Priority List
Source: EPA
Telephone: Not reported
National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 12/16/2014
Date Made Active at EDR: 02/09/2015
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 01/08/2015
Elapsed ASTM Days: 32
Date of Last EDR Contact: 01/08/2015

PROPOSED NPL: Proposed National Priority List Sites
Source: EPA
Telephone: Not reported
A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 12/16/2014
Date Made Active at EDR: 02/09/2015
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 01/08/2015
Elapsed ASTM Days: 32
Date of Last EDR Contact: 01/08/2015

DELISTED NPL: National Priority List Deletions
Source: EPA
Telephone: Not reported
The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 12/16/2014
Date Made Active at EDR: 02/09/2015
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 01/08/2015
Elapsed ASTM Days: 32
Date of Last EDR Contact: 01/08/2015

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

Source: EPA
Telephone: 703-412-9810

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Date Made Active at EDR: 02/13/2014
Database Release Frequency: Quarterly
Date of Data Arrival at EDR: 11/11/2013
Elapsed ASTM Days: 94
Date of Last EDR Contact: 02/27/2015

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Source: EPA
Telephone: 703-412-9810

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/27/2015
Date of Next Scheduled Update: 06/08/2015

RODS: Records Of Decision

Source: EPA
Telephone: 703-416-0223

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Database Release Frequency: Annually
Date of Last EDR Contact: 03/10/2015
Date of Next Scheduled Update: 06/22/2015

NPL LIENS: Federal Superfund Liens

Source: EPA
Telephone: 202-564-4267

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Made Active at EDR: 03/30/1994
Database Release Frequency: No Update Planned
Date of Data Arrival at EDR: 02/02/1994
Elapsed ASTM Days: 56
Date of Last EDR Contact: 08/15/2011

TX HWS: State Superfund Registry

Source: Texas Commission on Environmental Quality
Telephone: 512-239-5680

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 12/01/2014
Database Release Frequency: Semi-Annually
Date of Last EDR Contact: 03/13/2015
Date of Next Scheduled Update: 06/29/2015

TX LF: Permitted Solid Waste Facilities

Source: Texas Commission on Environmental Quality
Telephone: 512-239-6706

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 01/29/2015
Database Release Frequency: Quarterly
Date of Last EDR Contact: 01/26/2015
Date of Next Scheduled Update: 05/11/2015

SECTION 3: DATABASES SEARCHED AND UPDATE DATES

...Continued...

MULTIMEDIA

TRIS: Toxic Chemical Release Inventory System
Source: EPA
Telephone: 202-566-0250
Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Database Release Frequency: Annually
Date of Last EDR Contact: 01/29/2015
Date of Next Scheduled Update: 06/08/2015

SSTS: Section 7 Tracking Systems
Source: EPA
Telephone: 202-564-4203
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Database Release Frequency: Annually
Date of Last EDR Contact: 01/26/2015
Date of Next Scheduled Update: 05/11/2015

TSCA: Toxic Substances Control Act
Source: EPA
Telephone: 202-260-5521
Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012
Database Release Frequency: N/A
Date of Last EDR Contact: 12/22/2014
Date of Next Scheduled Update: 04/06/2015

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/23/2015
Date of Next Scheduled Update: 06/08/2015

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/23/2015
Date of Next Scheduled Update: 06/08/2015

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
Source: EPA
Telephone: 202-566-1667
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/23/2015
Date of Next Scheduled Update: 06/08/2015

FINDS: Facility Index System/Facility Registry System
Source: EPA
Telephone: Not reported
Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 08/16/2014
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/09/2015
Date of Next Scheduled Update: 06/22/2015

RMP: Risk Management Plans
Source: Environmental Protection Agency
Telephone: 202-564-8600
When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2014
Database Release Frequency: Varies
Date of Last EDR Contact: 01/26/2015
Date of Next Scheduled Update: 05/11/2015

STORMWATER: Storm Water General Permits
Source: Environmental Protection Agency
Telephone: 202-564-0746
A listing of all facilities with Storm Water General Permits.

Date of Government Version: 06/02/2005
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/05/2015
Date of Next Scheduled Update: 06/15/2015

ENG CONTROLS: Engineering Controls Sites List
Source: Environmental Protection Agency
Telephone: 703-603-0695
A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/18/2014
Database Release Frequency: Varies
Date of Last EDR Contact: 02/26/2015
Date of Next Scheduled Update: 06/15/2015

INST CONTROL: Sites with Institutional Controls
Source: Environmental Protection Agency
Telephone: 703-603-0695
A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/18/2014
Database Release Frequency: Varies
Date of Last EDR Contact: 02/26/2015
Date of Next Scheduled Update: 06/15/2015

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
Source: EPA Region 1
Telephone: 617-918-1313
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Database Release Frequency: Varies
Date of Last EDR Contact: 01/30/2015
Date of Next Scheduled Update: 05/11/2015

RADINFO: Radiation Information Database
Source: Environmental Protection Agency
Telephone: 202-343-9775
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/07/2014
Database Release Frequency: Quarterly
Date of Last EDR Contact: 02/27/2015
Date of Next Scheduled Update: 04/20/2015

LUCIS: Land Use Control Information System
Source: Department of the Navy
Telephone: 843-820-7326
LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/03/2014
Database Release Frequency: Varies
Date of Last EDR Contact: 02/16/2015
Date of Next Scheduled Update: 06/01/2015

US CDL: Clandestine Drug Labs
Source: Drug Enforcement Administration
Telephone: 202-307-1000
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 11/10/2014
Database Release Frequency: Quarterly
Date of Last EDR Contact: 03/03/2015
Date of Next Scheduled Update: 06/15/2015

2020 COR ACTION: 2020 Corrective Action Program List
Source: Environmental Protection Agency
Telephone: 703-308-4044
The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013
Database Release Frequency: Varies
Date of Last EDR Contact: 02/13/2015
Date of Next Scheduled Update: 05/25/2015

HEALTH AND SAFETY

OSHA: Occupational Safety and Health Administration
Source: DOL, OSHA, Office of Mgmt Data
Telephone: 202-693-1700
Specific inspection, violation and fatality/catastrophe information regarding inspections of interest.

Date of Government Version: 12/31/2013
Database Release Frequency: Annually
Date of Last EDR Contact: 12/19/2014
Date of Next Scheduled Update: 04/06/2015

TCEQ – Central Registry Query, Regulated Entity Information

Central Registry Query - Regulated Entity Information

Regulated Entity Information

RN Number: RN103032868
Name: EL DORADO CHEMICAL WHITEWRIGHT PLANT View Prior Names
Primary Business: No primary business description on file.
Street Address: 1102 S BOND ST, WHITEWRIGHT TX 75491 3012
County: GRAYSON
Nearest City: WHITEWRIGHT
State: TX
Near ZIP Code: 75491
Physical Location: No physical location description on file.

Affiliated Customers - Current

Your Search Returned **3** Current Affiliation Records (View Affiliation History)

1-3 of 3 Records

CN Number	Customer Name	Customer Role	Details
CN601176233	EL DORADO CHEMICAL COMPANY	OWNER OPERATOR	
CN601176233	EL DORADO CHEMICAL COMPANY	OPERATOR	
CN604536698	EDC AG PRODUCTS COMPANY LLC	OPERATOR	

Industry Type Codes

Code	Classification	Name
2875	SIC	Fertilizers

Permits, Registrations, or Other Authorizations

There are a total of **3** programs and IDs for this regulated entity. Click on a column name to change the sort order.

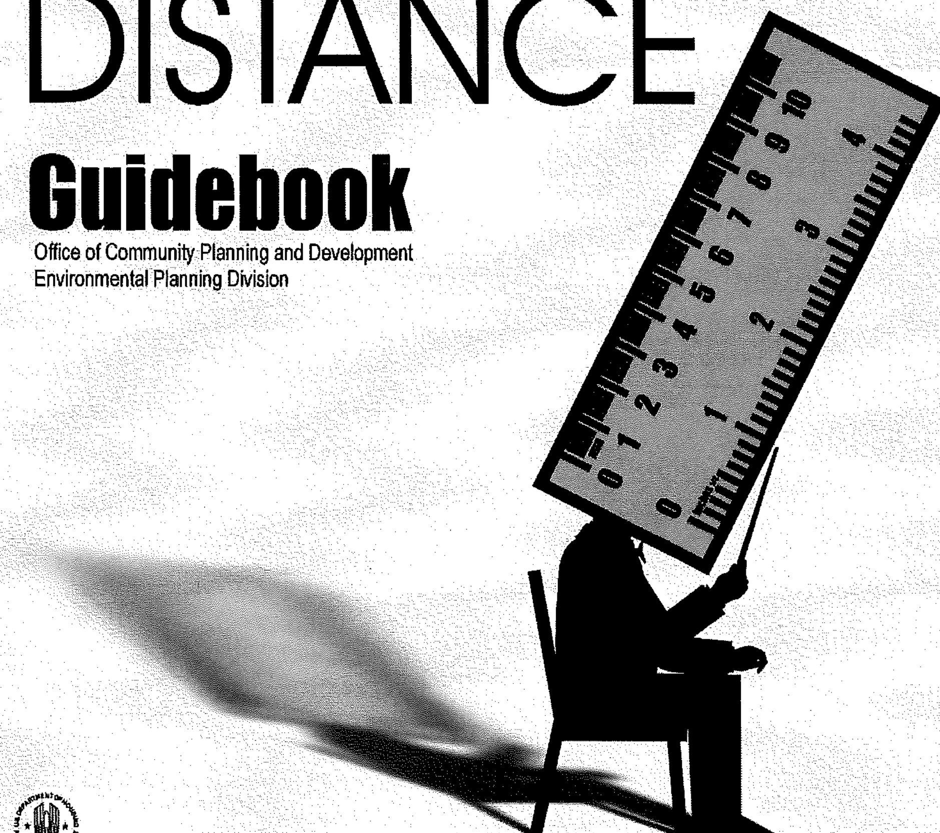
1-3 of 3 Records

Program▲	ID Type	ID Number	ID Status
IHW CORRECTIVE ACTION	SOLID WASTE REGISTRATION # (SWR)	T2449	ACTIVE
STORMWATER	PERMIT	TXR05CB17	ACTIVE
STORMWATER	PERMIT	TXR050755	CANCELLED

ACCEPTABLE SEPARATION DISTANCE

Guidebook

Office of Community Planning and Development
Environmental Planning Division



U.S. Department of Housing and Urban Development

Table of Contents

Acknowledgements

While numerous individuals contributed to the development of this guidebook we wish to acknowledge the following:

Region 10 – NW/Alaska
Deborah Peavler-Stewart – Regional Environmental Officer
Sara Jensen – Field Environmental Officer

Region 8 – Rocky Mountains

Region 7 – Great Plains
Paul F. Mohr – Regional Environmental Officer

Region 4 – Southeast/Caribbean
Lenwood E. Smith – Field Environmental Officer

Region 3 – Mid Atlantic
Paul J. Lehmann – Regional Environmental Officer
Susanne Sortichos – Field Environmental Officer

1. The South Hill play area and homes are located near above ground stationary storage containers in the South Hill neighborhood of Chesapeake, Virginia.

Introduction

This *Guidebook* focuses on the hazardous operations that can potentially harm HUD-assisted projects and the people who live or work there. It reflects the parameters established by 24 CFR Part 51 Subpart C, which regulates the technical requirements of determining Acceptable Separation Distances (ASDs) from HUD-assisted projects in proximity to hazardous operations.

Purpose

This *Guidebook* provides HUD staff, planners, developers, engineers and grantees with specific steps to determine the Acceptable Separation Distance (ASD) between a HUD-assisted project and a hazardous operation. It provides environmental review professionals with information about the implementation of regulation 21 CFR Part 51 Subpart C. The *Guidebook* also provides both the analytical foundation and recommended strategy for determining the distance between a proposed HUD-assisted project and a hazardous operations site.

Background

The technical material referenced in previous editions of this *Guidebook* was obtained from a December 1975 study[1] by Arthur D. Little, Inc., and a December 19, 1981 study[2] by Rolf Jensen and Associates (RJ&A), Deerfield, Illinois, for HUD. The previous iterations of these guidelines are:

- Urban Development Siting with Respect to Hazardous Commercial/ Industrial Facilities – HUD –777-CPD)
- Regulation 24 CFR Part 51C;HUD Handbook 1390.2, "Environmental Assessment Guide for Housing Projects"
- HUD Handbook 1390.4, ' A Guide to HUD Environmental Criteria and Standards contained in 24 CFR Part 51" and,
- Siting of HUD-Assisted Projects Near Hazardous Facilities.

Authority

HUD's authority to implement the information in this *Guidebook* is found in 24 CFR Part 51, Subpart C, "Siting of HUD – Assisted Projects Near Hazardous Operations Handling Conventional Fuels or Chemicals of an Explosive or Flammable Nature."
HUD-assisted projects are required to meet criteria, standards and guidelines for site acceptability and a suitable living environment as provided under the following statues:

a) The National Housing Act, which was enacted "to encourage improvements in housing standards and conditions, to provide a system of mutual mortgage insurance, and for other purposes, "thus

[1] Safety Considerations in Siting Housing Projects
[2] Urban Development in Siting with Respect to Hazardous Commercial/Industrial Facilities

providing the basis for HUD's Minimum Property Standards (MPS) which have evolved as required by legislation over the past 44 years;

b) The Housing and Community Development Act of 1974, as amended, which sets forth the national goal of "a decent home and a suitable living environment for every American family"; and

c) The National Environmental Policy Act of 1969, as amended, which directs Federal agencies to develop procedures to carry out the purposes of the Act.

The information in this *Guidebook* can be applied to the following activities:

- HUD-assisted projects as defined in 24 CFR 51.201.
  - Generally speaking, these are projects that are intended for residential, institutional (this category includes public and government buildings), recreational, commercial or industrial use that are planned for development, construction, rehabilitation, modernization or conversion (change of one state of phase to another) with HUD subsidy, grant assistance, loan, loan guarantee, or mortgage insurance.
  - The interpretation of the terms "rehabilitation" and "modernization" refer only to such repairs and renovation of the proposed HUD-assisted project that will result in an increased number of people being exposed to hazardous operations by increasing residential densities, converting the use of a building to human habitation, or making a vacant building habitable.

Exclusions

The information contained in this *Guidebook* and in the ASD assessment tool **do not apply** in the following situations, which are excluded from Part 51 Subpart C:

a. **Underground Storage Containers**: If the container is buried (see glossary), there is no need for an ASD.

b. **Stationary above-ground containers of 100 gallons or less capacity that hold *common liquid industrial fuels***: Results from the December 19, 1981 study[3] by Rolf Jensen and Associates (RJ&A), Deerfield, Illinois, demonstrated that stationary containers of 100 gallons or less capacity that store common liquid industrial fuels (such as gasoline, fuel oil, kerosene and crude oil) do not emit thermal radiation heat flux effects at levels that would pose a danger to HUD-assisted projects. **Note:** This exception ***does not apply*** to above-ground stationary containers that store hazardous gases, such as those listed in Appendix I of the Regulation or in Appendix C of this guidebook.

c. **Natural gas holders with floating tops**: These are stationary above-ground storage containers used to store natural gas. These containers are less susceptible to corrosion and tank perforations that can cause Bleves (rupture explosions).

[3] Urban Development in Siting with Respect to Hazardous Commercial/Industrial Facilities

d. **Mobile conveyances *(tank trucks, barges, railroad tank cars)***: These are containers that are mobile and have the capacity to store common liquid industrial fuels or hazardous gases as listed in Appendix I of the regulation 24 CFR Part 51 Subpart C and in Appendix C of this *Guidebook*.

e. **Pipelines, such as high pressure natural gas transmission pipelines or liquid petroleum pipelines**: Pipelines that transmit hazardous substances are not considered a hazard under 24 CFR Part 51 Subpart C if they are located underground or if they comply with applicable Federal, State or local safety standards.

Applications

Regulation 24 CFR Part 51, Subpart C, the ASD assessment tool, and the information in this *Guidebook* apply only to above-ground stationary containers of more than 100 gallon capacity that hold common liquid industrial fuels (for more information, please see Appendix I of the Regulation and Appendix C of this *Guidebook);* and above-ground stationary containers of any capacity that hold hazardous liquids or gases (see glossary) that are not common liquid industrial fuels (see also the list of hazardous substances in Appendix C of this *Guidebook*).

Frequently Asked Questions

To help you understand and apply the information in this *Guidebook*, what follow are questions HUD-field environmental officers ask most frequently.

1. 1a. Is there a list of steps to assess whether a proposed HUD-assisted project is too close to a hazardous facility?
1b. Is there a procedure for calculating the ASD?

1a. Yes. That information is located in Chapter 4. There you will find the steps necessary for assessing the proposed HUD-assisted project and examples using the Nomographs (Worksheets #1 through #4).
1b. Yes. Chapter 4 has manual calculation procedures. Chapter 4 and Appendix A provide detailed flowcharts on how to calculate the ASD for blast-overpressure, thermal radiation or both. You can also calculate the ASD by using the ASD assessment tool available on HUD's environmental webpage at
http://www.hud.gov/offices/cpd/environment/asdcalculator.cfm .

2. 2a. Which guidelines apply when the proposed HUD-assisted project site does not meet the standard and mitigation is required?
2b. Is there detailed information available on mitigation analysis?

2a. Chapter 5 (Mitigation Options) provides the basic information and steps required for a mitigation analysis. The results of this analysis provide key information that will help you determine if mitigation is required. Chapter 5 also provides flowcharts on the mitigation analysis for a site that has natural and man-made barriers if the ASD cannot be achieved between the site and the hazard being assessed.

2b. Yes. Key information on mitigation analysis can be found in Chapter 5.

3. **Are there guidelines for chemicals that are held in above-ground stationary containers?**

Yes. These guidelines can be found in Appendix C (Data Resources).

4. **Aside from the manual calculation procedure (Nomographs) or the ASD assessment tool, is there another way to access already calculated ASD results based on the volume of the container?**

Yes. There are 2 charts with ASD results (one for blast-overpressure, the other for thermal radiation) based on the volume of the container. These charts are located in Appendix C.

5. **Is there a form to request a 51 C analysis regarding a potential hazardous site near a proposed HUD-assisted project?**

No, however, there is a form in Appendix C to Request for Headquarters Analysis of Potential Hazardous Site, that details the information required to begin a 51 C analysis.

6. **Is there a list of commonly asked questions on Regulation 24 CFR Part 51 Subpart C?**

Yes. Those questions and answers can be found in Chapter 4, Evaluations and Guidelines. This section will also help you understand important changes that have occurred since the publication of the September 1996 "Siting of HUD-Assisted Projects Near Hazardous Facilities."
This edition of the *Guidebook* updates information and unresolved policy statements and principles. There are no 24 CFR Part 51 Subpart C policy changes in this guidebook.

7. **How are Self-Contained Above Ground Containers (SCAC's) evaluated for calculation of the ASD?**

For calculation of the ASD, SCAC's have two external walls. The first wall serves to contain the product; the second serves to prevent spills outside of the container if the first wall ruptures. The interstitial space (the space between the first and the second wall) serves to control spillage if a rupture in the container's internal wall occurs. **Note:** SCAC's are considered containers without a dike, **and calculations must be done for containers without a dike area**.

Chapter 1 – Overview: Organization of the *Guidebook*

Petrochemical gases and liquids are used worldwide. Their demand varies depending on the consumer. Domestic household consumers use petrochemicals to cook, heat their homes and water tanks and run appliances. Commercial consumers such as restaurants, office buildings, hotels and gas stations use petrochemicals to run their businesses. Industrial consumers such as power stations, material manufacturers, pharmaceutical and medical researchers, automotive and tool manufacturers use petrochemicals to support the demands of purpose of their industries.

Regulation 24 CFR Part 51 Subpart C applies specifically to the petrochemical liquids and gases that could ignite and explode and that are stored in above-ground, stationary containers such as those ones listed in Appendix I of the Regulation and in Appendix C of this *Guidebook*.

This *Guidebook*, as well as 24 CFR Part 51 Subpart C and the ASD assessment, are tools designed to determine whether a proposed HUD-assisted project site is too close to a facility with potentially hazardous stationary above-ground containers. They are tools that also help environmental review professionals understand and implement the regulation 24 CFR Part 51 Subpart C.

This latest edition of the *Guidebook* is a revision of the September 1996 "Siting of HUD-Assisted Projects Near Hazardous Facilities." This latest edition corrects inconsistencies and removes either questionable or unresolved policy statements and principles. There are no changes in this *Guidebook* to 24 CFR Part 51 Subpart C.

Additional features in this revision include:

- Flowcharts that illustrate
    1. Site analysis steps for ASD calculation (procedures and findings for a HUD-assisted project);
    2. Procedural calculation of the ASD for thermal radiation (fire) or blast-overpressure (explosion);
    3. Procedural calculation of the ASD for blast-overpressure (explosion) and thermal radiation provided the substance being assessed has flammable or combustible properties and is pressurized; and
    4. Mitigation analysis for a proposed HUD-assisted project.
- Examples of multiple mitigation options involving natural and man-made barriers.
- A section on "Frequently Asked Questions" about 24 CFR Part 51 Subpart C.

This *Guidebook* contains an Introduction, 6 Chapters and 6 Appendices.

Introduction: Outlines purpose, background, authority, exclusions, applications and limitations and frequently asked questions.

Chapter 1: *Overview* reviews the purpose and background of the *Guidebook,* providing important basic information, as well as frequently asked questions.

Chapter 2: *Regulatory Framework* discusses the foundation and structure of 24 CFR Part 51 Subpart C and the need to develop the standards of blast-overpressure and thermal radiation from which the ASD is calculated for the proposed HUD-assisted project.

Chapter 3: *Compliance Process* outlines the process to follow in order to comply with the Regulation.

Chapter 4: *Evaluations and Findings* explains and outlines the procedures required to evaluate proposed HUD-assisted projects that are in close proximity to a potentially hazardous site.

Chapter 5: *Mitigation Options* provides information about mitigation analysis and how to determine if mitigation is required on a proposed HUD-assisted project.

Chapter 6: *Extraordinary Circumstances* identifies extraordinary circumstances under which proposed HUD-assisted projects are subject to consultation by HUD-Regional and Field Environmental Officers. Under these circumstances, additional detailed information and procedures that are not provided in 24 CFR Part 51 Subpart C would be required.

2. A house sits near storage tanks in the South Hill neighborhood of Chesapeake, Virginia

Chapter 2 - Regulatory Framework

History:

Before the development of 24 CFR Part 51 Subpart C, HUD received inquiries from developers, planners, engineers, HUD field staff and grantees about how to determine Acceptable Separation Distances (ASDs) for HUD-assisted projects near stationary facilities that store, handle or process explosive or fire prone substances. Answering those inquiries involved determining the potential blast-overpressure and thermal radiation effects of the hazard. The "area impacted from the blast-overpressure or thermal radiation" was called a "hazard to buildings or people zone." Most of the proposed HUD-assisted projects were either greatly reduced in scope by the need to eliminate the "hazards to buildings or people zone" of the project or not approved.

The analysis involved in determining how the hazard might delay HUD-assisted project approval because there were no standards established from which an ASD could be determined for explosives or fire-prone substances. As a result, HUD decided that there was a need for the development of two standards:

1. Thermal Radiation – Applicable to people and buildings
2. Blast Overpressure – Applicable to buildings, building occupants and outdoor unprotected facilities

HUD researched the most relevant sources of information at the time regarding how stored flammable substances affect people and structures. The research, which included a review of federal agencies, professional organizations, regulatory agencies, and councils and boards, revealed that the existing standards specific to each entity's function and purpose were limited in both scope and application.

The following are some of the entities that were involved in the research study:

1. Federal Fire Safety Standards: The Federal Fire Safety standards for Liquified Natural Gas (LNG) Facilities establish thermal radiation standards that are applicable only to LNG facilities.
2. National Fire Protection Association (NFPA): The NFPA fire standards are limited to fire hazards and are for the specific use of industry in the determination the internal configuration of petrochemical facilities.

The first research project was meant to develop appropriate standards for blast-overpressure and thermal radiation and a method for calculating Acceptable Separation Distances (ASD's) for HUD-assisted projects. The study,[4] prepared by Arthur D. Little, Inc. and titled "A Notice of Proposed Rulemaking (NPR)," was completed in December of 1975. After extensive review and commentary, the standards for blast-overpressure and thermal radiation were established and published in the Federal Register on August 19, 1980.

[4] Safety Considerations in Siting Housing Projects

Due to additional comments gathered from the NPR, as well as comments from other industry experts, HUD decided to do a second research study,[5] with the purpose of addressing two concerns:

1. Simplifying the method of calculating of the Acceptable Separation Distance (ASD) between HUD-assisted projects and stationary hazards and,
2. Modifying standards already developed by the first study to include additional substances that were mostly used as fuels in the industry.

A second research project, done by Rolf Jensen and Associates, Inc., of Deerfield, Illinois, under contract to HUD, provided the required technical support and was used to address HUD concerns and to complete the current 24 CFR Part 51 Subpart C and the previous editions of this *Guidebook*. Regulation 24 CFR Part 51 Subpart C became effective on February 10, 1984, and amended on March 26, 1996. The research from the Rolf Jensen and Associates study were encapsulated in a report titled *Urban Development Siting with Respect to Hazardous Commercial/ Industrial Facilities.*

Average fire data at stationary bulk liquid fuel storage facilities from 1994 to 1998. Data[6] provided from the National Fire Protection Association (NFPA).

Total :	Damage off premises :
Annual average fire incidents : 387	Annual average fire incidents : 288
Casualties : 1	Casualties: 0
Injuries : 8	Injuries: 3
Direct Property Damage : $5,540,000	Direct Property Damage: $948,000

Average fire data at stationary LP-gas fuel storage facilities from 1994 to 1998. Data[7] provided from the NFPA.

Total :	Damage off premises :
Annual average fire incidents : 49	Annual average fire incidents : 26
Casualties : 1	Casualties: 0
Injuries : 5	Injuries: 1
Direct Property Damage : $722.00	Direct Property Damage: $117,000

The data presented supports the reason behind the development of the ASD under the regulation 24 CFR Part 51 Subpart C, which is to avoid injuring people or destroying property by properly assessing the distance between project sites and facilities that store, handle or process flammable or combustible chemicals.

This edition of the *Guidebook* incorporates the results of the 1981 Rolf Jensen and Associates study. Later experiments at the National Institutes of Health (see footnote 10) confirm the Regulation standards of thermal radiation for people (450 BTU/ft^2-hr) and the effect of heat on exposed human skin.

---

[5] Urban Development Siting with Respect to Hazardous Commercial/Industrial Facilities
[6] Fires at Flammable or Combustible Liquid Tank Storage Facilities: Statistical Analysis
[7] Fires at LP-Gas Bulk Storage Plants: Statistical Analysis

A review of the Thermal Radiation Standard - Buildings

The standard for the determination of an Acceptable Separation Distance (ASD) for thermal radiation is based on heat flux. A report[8] from ABS consulting indicates that exposures of as little as 4,000 BTU/ft^2-hr can cause ignition of wooden structures. Referenced studies[9] show that the maximum thermal radiation exposure that combustible materials can tolerate for a long period of time, without being susceptible to pilot ignition, is 4,000 BTU/ft^2-hr. From 5,000 BTU/ft^2-hr to 9,000 BTU/ft^2-hr, the tolerance on combustible materials on the maximum thermal radiation exposure reduces gradually as the thermal heat flux increases.

According to the Department of Homeland Security, United States Fire Administration/National Fire Data Center, response times for structure fires are generally less than 5 minutes 50 percent of the time, regardless of region, season, or time of day. The nationwide 90th percent response time to structural fires is generally less than 11 minutes.

The maximum thermal radiation heat flux exposure to buildings is 10,000 BTU/ft^2-hr for a maximum duration of 15 minutes.

This is based upon the assumption that there will be fire department response to protect exposed combustible buildings within 15 minutes and that the exposed combustible materials will not spontaneously ignite before the fire department responds.

Modern multi-occupant buildings and homes made from wood are more fire resistant than before. (Research and development of fire resistant wood started in 1985 and was fully implemented in the construction of buildings and residences by 1997). With updated developments on advanced additives incorporated into wood and the substitution of plastic wood in homes and multi-occupant buildings, it takes more than 15 minutes for exposed combustible materials to ignite spontaneously, which is well within fire department response times. For multi-occupant buildings constructed before 1985, the fire department response time is well within the time limits at which exposed combustible materials spontaneously ignite.**Therefore, a parameter standard of 10,000 BTU/ft^2-hr is considered the acceptable level of thermal radiation for buildings.**

A Review of the Thermal Radiation Standard - People

Human skin reacts to heat by perspiring and increasing blood flow to the affected area. Pain is felt when skin temperature rises to just above 44° C or 111° F over a depth of 0.1mm (Normal is 37° C or 98.4° F). 44° C is an approximate value due to various skin depths, body fat, etc.

The National Library of Medicine and the National Institutes of Health and in collaboration with the Food and Drug Administration, performed an oximeter study[10] to

---

[8] ABS consulting, Risk consulting Division, table 2.9, page 34, various Thermal Radiation Limits for Structure from Lees (1996).

[9] Loss Prevention in the Process Industries

[10] "Temperature Threshold for burn Injury, an Oximeter Safety Study", National Library of Medicine and the National Institutes of Heath report, 2004., Greenhalgh, G.H., Lawless, B.B. Chew, W.A. Crone, M.E. Fein, T.L. Palmieri.

determine the temperature threshold for burn injury. Pulse oximeters, essential devices for evaluating and monitoring patient oxygenation, emit a small amount of heat into the skin then detect a signal.

The standard for thermal radiation flux level for open spaces such as parks and playgrounds where people of all ages congregate is based on the time it would take to react and find protection from a fire hazard.

At 41° C or 106° F, the thermal heat flux is 175.3 BTU/ft^2-hr. At this heat flux level, people in open spaces will experience some degree of "redness" on their skin depending on their distance from the hazard, exposure time and atmospheric conditions such as wind temperature and speed, etc. This set parameter of thermal heat flux (175.3 BTU/ft^2-hr) is the normal standard for protection of people in outside environments.

At 55° C or 228° F, the thermal heat flux is 450 BTU/ft^2-hr. At 55° C or 228° F, people in open spaces will experience a much greater degree of "redness" on the skin, depending on the distance from the hazard, exposure time and atmospheric conditions such as wind temperature and speed, etc. This set parameter of thermal heat flux (450 BTU/ft^2-hr) is the maximum limit standard for protection of people in open spaces.

Therefore, the maximum set level parameter of 450 BTU/ft^2-hr is considered the acceptable level of thermal radiation for people in open spaces where people congregate, such as parks and playgrounds, etc.

A Review of the Blast-Overpressure Standard - Buildings

The criteria for determining Acceptable Separation Distances (ASD's) for blast-overpressure is based on the pressure wave exerted by detonation of a set mass quantity of TNT.

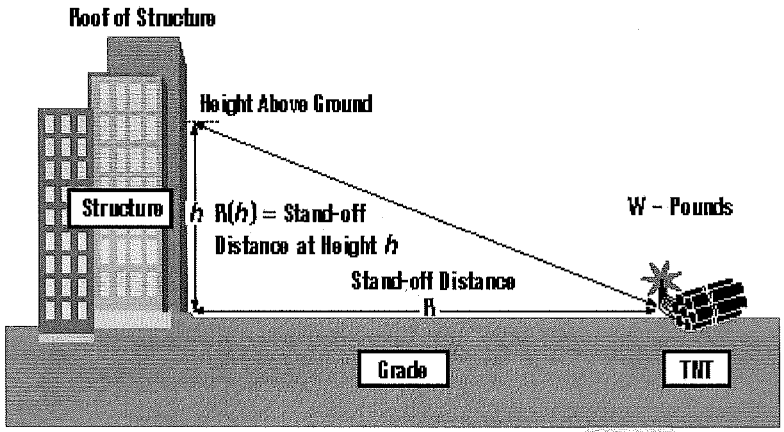
The method of comparison, also known as the "TNT Equivalent," is used because the blast-overpressure produced by 1 pound of TNT is known. This is the TNT equivalent weight of the actual explosive.

The TNT equivalent weight is defined by W (in pounds) = mass of the explosive in question times its relative strength.

For reference purposes, virtually all explosives have TNT equivalent weights within a factor of 1.4 of their physical weight.

Therefore, the mathematical formula to calculate the scaled distance (Z) is $Z = R/W^{1/3}$, where
W = pounds of TNT equivalent weight at a distance R (the stand off distance) from the vertical exterior wall of a building (example).

Below is a visual representation of a hazard (TNT equivalent weight – W) and the standoff distance (R) between the explosive hazard and a structure.



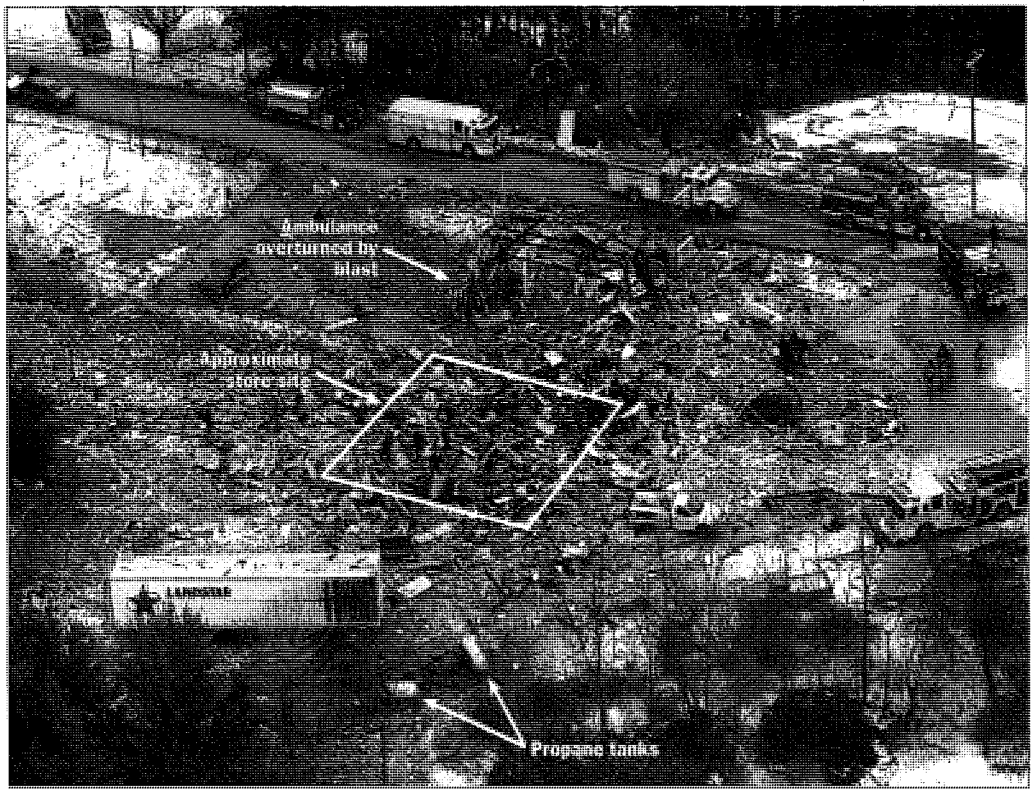
The following table illustrates several test results developed by a Department of Defense and Sandia National Laboratories study[11] of explosives detonation and the blast-overpressure effects on different materials. The amount and type of explosive used and the distance between the explosives and the structural element were not released as part of the results of the subject study.

Structural element	**Overpressure effects on structural element**	**Approximate peak positive incident pressure recorded on structural element (psi)**
Glass windows, large and small	Shattering usually, occasional frame failure	0.5- 1
Corrugated asbestos siding	Shattering	1.0- 2.0
Corrugated steel or aluminum paneling	Connection failure following by buckling	1.0-2.0
Brick wall panel, 8in, or 12 in thick (not reinforced)	Shearing and flexure failures	3.0-10.00
Wood siding panels, standard house construction	Usually failure occurs at the main connections allowing a whole panel to be blown in	1.0- 2.0
Concrete or cinder-block wall panels, 8 in, or 12 in thick (not reinforced)	Shattering of the wall	1.5- 5.5

[11] "Effects of Nuclear Weapons, Conditions of failure of overpressure-sensitive elements", Table 5.145, page 221, 1997., Glasstone, S., and P.J. Dolan

The most current standard developed from testing on window systems, as used on GSA buildings and Department of State embassies (Applied Research Associates, Inc.), reflects a standard for glass overpressure of 0.5 psi.

Therefore, the parameter standard of 0.5 psi is the maximum allowable pressure that can be measured at a distance from an explosive hazard when selecting a site for HUD- assisted housing and occupants.



3. The aftermath of the January 30, 2007 propane blast at the Little General Store in Ghent, West Virginia. Enhancements note the approximate location of the store, the propane tanks and the ambulance overturned in the explosion.

Chapter 3 - Compliance Process

HUD-assisted projects (as defined in 24 CFR 51.201) shall be in compliance with 24 CFR Part 51 Subpart C. The implementation of the Regulation is the responsibility of the HUD approving official (certifying officer) or responsible entity.

The Regulation addresses protection of buildings and people when siting HUD-assisted projects near hazardous operations that handle conventional fuels or chemicals of an explosive, combustible or flammable nature.

For a HUD-assisted project to be in compliance with the regulation 24 CFR Part 51 Subpart C, the project location must be within the Acceptable Separation Distance (ASD) established by HUD from facilities that store, handle or process explosive or fire prone substances.

The key steps to complying with the regulation 24 CFR Part 51 Subpart C are as follows:

Step 1: Identify hazardous operations/facilities with stationary, aboveground storage tanks in proximity of the proposed HUD-assisted project site.

Step 2: Calculate the ASD between the proposed HUD-assisted project site and the hazardous facility using thermal radiation and blast overpressure standards.

Step 3: Determine whether the project site meets the standard.

Step 4: If the project meets the standard, no further action is required. However, if the project does not meet the standard, mitigation (covered in detail in Chapter 5) may be required.

The ASD is prescribed from the standards set out in the regulation 24 CFR Part 51 Subpart C, as follows:

- Thermal Radiation, 10,000 BTU/ft^2 - hr
  - Applicable to buildings
- Thermal Radiation, 450 BTU/ft^2 – hr
  - Applicable to people
- Blast-Overpressure, 0.5 psi
  - Applicable to buildings, building occupants and outdoor unprotected facilities

To protect buildings and housing units from thermal radiation, HUD established the thermal radiation standard of 10,000 BTU/ft^2 – hr.

To protect people in outside areas, such as patios or common areas, or in places where communities congregate, like parks or recreation areas, HUD established the thermal radiation standard of 450 BTU/ft^2-hr. If no mitigation exists or is implemented, it is required to build HUD-assisted projects to the ASD at which the thermal radiation flux will not exceed 450 BTU/ft^2-hr.

Blast overpressure can harm people or destroy buildings if this pressure is higher than 0.5 psi. For proposed HUD-assisted project sites where there are stored hazards that can cause blast overpressures and no mitigation, it is required to build to the ASD at which this pressure is no higher than 0.5 psi.

HUD will not approve applications for assistance unless 1) the proposed project meets the required ASD from the facility assessed as hazardous; or and 2) appropriate mitigation measures or plans for appropriate mitigation are implemented.

Appropriate mitigation measures are classified as either natural or man-made structures that shield or serve as an abatement to the HUD-assisted project site from the blast overpressure and/or thermal radiation effects from the hazard. Whether natural or man-made, mitigation measures shall be stationary, of adequate size and strength, and located between the hazard and the proposed HUD-assisted project site, and shall shield all points of the project from the line of sight exposure of the hazard. (Chapter 5 of this *Guidebook* covers mitigation measures in detail.)

If the HUD-assisted project is a facility that will process, manufacture or store hazardous substances, HUD will not approve applications for assistance unless the proposed project is located at the required ASD from housing developments and from facilities or areas where people congregate or engage in outdoor activities.

In the case for all applications for HUD-assisted projects, the Department shall evaluate projected development plans for the installation or existence of hazardous operations near the location of the proposed HUD-assisted project. If such hazardous facility exists, or there are plans for the development of such facility, the project must comply with the standards of the Regulation, or adequate mitigation measures must exist, or the Department must obtain satisfactory assurances that adequate mitigation measures will be taken where the hazardous operation is installed before the Department approves the applications for development of such projects.

4. Fire and smoke caused by the explosion of a propane tank at a maintenance facility for Como Oil, located at Duluth, Minnesota.

Chapter 4 – Evaluations and Findings

To determine if the proposed HUD-assisted project meets the established standards for blast-overpressure or thermal radiation, HUD or the responsible entity is required to calculate the Acceptable Separation Distance (ASD) between the proposed project and the hazardous facility.

The following steps are intended to help the user of this *Guidebook* understand the required process necessary for evaluating a HUD-assisted project that is located in close proximity to a potentially hazardous site.

Step 1: Obtain a map, site plan or photos of the proposed HUD-assisted project site and surrounding areas.

- Maps
    - Scaled maps with site contours (topographic maps) are highly recommended for the analysis of proposed HUD-assisted project sites. These maps make it easier to determine the existence of natural or man- made barriers and to perform an analysis of these barriers with reference to the location of the facility storing hazardous or explosive hazards.
    - Topographic maps or site maps can be obtained from the United States Geological Survey (USGS), City or County engineer's or planning office related to the proposed HUD-assisted project.
    - Digitized topographic maps (free of cost) can be obtained from the World Wide Web (WWW) for general public use from the following sources. (HUD does not endorse any of the referenced electronic sources of information.)
        - Yahoo Maps, http://developer.yahoo.com/maps/
        - Google Earth, http://earth.google.com/
    - Site maps provide geographic site information for recognizance and analysis of the various facilities near proposed HUD-assisted project sites.

- Site plans
    - Site plans provide detailed existing land-use information for proper identification and analysis of the areas comprising the proposed HUD-assisted project site. Site plans may be obtained from the engineer's, planning or developer's office working on the HUD-assisted project.

- Photos
    - Aerial photographs may be available from the developer of the HUD-assisted project, local commercial survey firms or planning departments.
    - Site photographs provide actual images of the facilities near proposed HUD-assisted project sites and nearby land uses when current. Site photographs provide valuable information for site evaluation. This information can be gathered (camera required by the person gathering the information) by scheduling a visit to the hazardous facility (making

sure that photographs are allowed) to be assessed and contacting the facility site manager.

Step 2: Use the maps, photos and plans of the proposed HUD-assisted project site, identify the following:

- HUD-assisted project site boundaries – to determine the area where facilities that store, manufacture or process hazardous substances are located, plot a mile-radius perimeter from the center of the proposed HUD-assisted project site.
    - Consider all the stationary, above-ground containers containing hazardous substances that can pose a hazard to the buildings or open areas where people congregate, play, etc., associated with the HUD-assisted project.
    - Collect the following information for each container to be considered:
        - Container's capacity (in gallons).
        - Container's product chemical name (not the trade name).
        - Container's product phase of state (gases or liquids).
        - If the container is unpressurized (containing liquids), find out if the container is diked or undiked. If it is diked, determine the dike area (**Length** times the **Width** - in square feet units).
    - Measure the distance between the proposed HUD-assisted project site and the container(s) being assessed.

When plotting the actual distances from the hazards in stationary, above ground storage containers, always measure the distance from the center of the containers to the perimeter of the proposed HUD-assisted project site.

Actual distances from the hazards to the buildings or open areas where people congregate should be plotted in "feet" units. This distance must be measured from the center of the above-ground storage container(s) to the perimeter of the proposed HUD-assisted project site.

- Determine which container(s) to use in making ASD calculations.

Guidelines on container evaluation (applies to pressurized and non-pressurized containers) for ASD calculations

How do you evaluate your containers for each facility?

- When there is a facility with stationary above-ground storage containers and diked areas of the same size, the ASD needs to be calculated for the container or diked area closest to the proposed HUD-assisted project site.
- When there is a facility with stationary above-ground containers and diked areas of different sizes, the ASD needs to be calculated for the container or diked area of largest capacity closest to the proposed HUD-assisted project site.
- When there is a facility with the same type of stationary above-ground containers of different capacity and the smaller capacity container is the one closest to the proposed HUD-assisted project site, the ASD must be calculated for the container that is closest

How do you evaluate your containers for each facility?

to the proposed HUD-assisted project site, as well as the largest capacity container.

- Calculate the ASD for the stationary container of largest capacity (whether pressurized or unpressurized) closest to the proposed HUD-assisted project. Always calculate the ASD for the pressurized container, regardless of its location. Consider only aboveground storage tanks.

Information on containers:

Within the regulation 24 CFR Part 51 Subpart C, there are 5 types of above-ground stationary containers, as follow:

This *Guidebook*, Regulation 24 CFR Part 51 Subpart **C**, and the ASD assessment tool **all apply** to these types of containers.

1. Pressurized containers (gases) designed to store a liquid-gas mixture substance under pressure. If the substance contained is a hazardous substance, the ASD for this container must be calculated for blast-overpressure (explosion) and thermal radiation (fire). If the substance contained is not of a flammable or combustible nature, the container does not need to be considered for the ASD analysis.

2. Pressurized containers (gases) holding cryogenic hazardous substances kept in a liquid state by temperature control, consider ASD calculations for fire. For hazardous cryogenic gases kept in gas phase, consider ASD calculations for fire and explosion. Hazardous cryogenic gases are kept in their liquid state at very low temperatures by refrigeration, insulation, etc. Hazardous cryogenic gases (e.g., Liquefied Natural Gas and Hydrogen) are listed under the "Hazardous Gases" list located in Appendix I of Subpart C and at Appendix C of this *Guidebook*.

3. Unpressurized containers designed to store a substance in a liquid phase of state (for liquids), calculate the ASD for thermal radiation (fire) only if the substance is of a hazardous nature. Since the substance contained is not under pressure, there is no need to calculate the ASD for blast-overpressure (explosion). If the liquid substance contained is not of a hazardous nature, the container does not need to be considered for the ASD analysis.

This *Guidebook*, Regulation 24 CFR Part 51 Subpart C and the ASD assessment tool **do not apply** to these types of containers.

4. Underground storage containers (liquids or gases) that are designed to store liquids or gases that are placed under the ground do not apply under this *Guidebook*, the regulation 24 CFR Part 51 Subpart C, or the ASD assessment tool.

5. Retrofitted mobile containers (tank trucks, barges, railroad tank cars containing liquids or gases) that have the capacity to store common liquid industrial fuels or hazardous gases as listed in Appendix I do not apply under this *Guidebook*, the regulation 24 CFR Part 51 Subpart C, and the ASD assessment tool.

Recommended guideline on calculating the ASD for pressurized and non-pressurized containers:

This is an ASD calculation guideline for pressurized containers. The diked area is never used for calculation of the ASD in pressurized containers.

1. The ASD calculation will not be affected by the diked area on pressurized containers (hazardous or non-hazardous substances) because gases occupy the volume of a container. If a leak occurs, the gas escapes to the atmosphere while the liquid boils and turns into vapor. Therefore, the diked area is not considered in the analysis.

ASD calculation facts on unpressurized containers:

These are ASD calculation facts for non-pressurized containers. Undiked , unpressurized containers have a larger ASD numerical value than diked because the dike defines the fire width as a controlled fire.

1. If the container is diked: the ASD will be of a smaller numerical value for diked containers vs. undiked containers storing hazardous liquids because the diked area defines the fire width, limiting the flames, heat dispersion and extension.
2. If the container is undiked: the ASD will be of a larger numerical value for undiked containers storing hazardous liquids. Without the dike area, the fire has no boundary or controlled perimeter.

Step 3: Calculate the ASD for the proposed HUD-assisted project:

The ASD can be calculated between a proposed HUD-assisted project and a facility that stores, handles or processes hazardous substances for:

- Thermal radiation (fire)
- Blast-Overpressure (explosion)
- Or both

Steps 1 and 2 of this Chapter, provide the user of this *Guidebook* with the steps required to gather the data necessary for calculating the ASD between a proposed HUD-assisted project and a facility that stores, handles or processes hazardous substances.

Flowcharts illustrating procedural calculation of the ASD for Thermal radiation, blast-overpressure or both can be found in Appendix A.

The ASD can be calculated using one of the following methods:

Manual Calculation (Nomographs)

Using the Nomographs located in Appendix B, calculate the ASD by plotting the required information (represented by the x- axis) to the respective graph (graphs are represented by a logarithmic line, as in worksheets #1 through #4, Appendix B) and then plotting the intersection point (between the x-axis and the graph) to the y- axis. The y-axis represents (depending on the worksheet) an interim calculation result required in the procedure to obtain the ASD or the ASD.

Electronic based calculation (The ASD Assessment Tool)

The web-based tool for calculation of the ASD offers an electronic application of the manual approach to calculation requirements contained in regulation 24 CFR Part 51 Subpart C and this *Guidebook*. Mathematical equations were derived from the Nomographs located in the Regulation and applied to the component parts of the assessment to determine the ASD between a proposed HUD-assisted project site and facilities that store, handle or process hazardous substances. This tool is accessible through the following URL:http://www.hud.gov/offices/cpd/environment/asdcalculator.cfm

Acceptable Separation Distance Principles

Most of these principles have been cited through the previous chapters of this *Guidebook*. However, because of their significance in the Regulation, they are all reiterated here:

1. There are two standards from which ASD calculations are produced:

    - Thermal Radiation (fire)
        - Buildings – 10,000 BTU/ft^2 – hr
        - People – 450 BTU/ft^2 – hr
    - Blast-Overpressure (explosion)
        - Buildings, building occupants and outdoor unprotected facilities– 0.5 psi

2. When measuring the ASD between a proposed HUD-assisted project and a facility that stores, handles or processes hazardous substances, always measure from the center of the stationary container containing the hazardous substance to the perimeter of the proposed project site. The perimeter is defined as the path or boundary that surrounds an area. In the case of proposed HUD-assisted projects, this area is the site where the project will be developed.

3. ASD calculations must be made between a proposed HUD-assisted project and a facility that stores, handles or processes hazardous substances. When calculating the ASD for thermal radiation for people, outdoor areas where people congregate must be assessed, such as:

    - Playgrounds
    - Outdoor recreation areas (parks, yards, planned open space)
    - Balconies
    - Residential parking lots (only parking lots associated to residential projects are considered applicable to the Regulation, since they are open spaces for congregation)

4. For stationary, above-ground **pressurized** containers that hold hazardous substances, the ASD calculations are generally required for blast-over pressure and thermal radiation.

5. For stationary, above-ground **unpressurized** containers that hold hazardous substances, the ASD calculations are generally required only for thermal radiation.

6. The diked area (in square feet) has an effect only on ASD calculations involving stationary, above-ground **unpressurized** containers that store hazardous substances. The diked area does not have an effect on ASD calculations involving stationary, above-ground **pressurized** containers that hold hazardous substances.

7. The information contained in this *Guidebook* and the ASD assessment tool do not apply in the following situations, which are excluded from Part 51 Subpart C (see page 4 for details):

    - Underground storage containers

- Stationary containers of 100 gallons or less capacity containing common liquid industrial fuels
- Natural gas holders with floating tops
- Mobile conveyances (tank trucks, barges, railroad tank cars). Mobile conveyances, while performing fuel operations (loading or unloading fuel, etc.) into a gas station, fuel transfer or storing facility, are not to be considered as part of the ASD analysis for the proposed HUD-assisted project if the proposed project is the fuel transfer or storing facility, since in the fuel operation process (mobile conveyance being stationary), there is the release of fumes from the fueling operation procedure, therefore, moving conveyances do not apply to the Regulation.
- Pipelines, such as high pressure natural gas transmission pipelines or liquid petroleum pipelines.
- Release of toxic gases or liquids, distribution piping associated with a container or process vessel

8. If a proposed HUD-assisted project has more than one ASD, the ASD which assures the greatest separation distance will be applied to the proposed project.

9. If the actual separation distance between the hazardous facility-tank and the proposed HUD-assisted project is greater than the ASD, then the actual separation distance is acceptable for the proposal.

10. If the actual separation distance between the hazardous facility-tank and the proposed HUD-assisted project is less than the ASD, then the site is unacceptable unless natural or man-made mitigation measures already exist or are implemented between the above-ground stationary hazard and the proposed project site.

11. Consider the ASD for thermal radiation (fire) only for gases kept in a liquid phase of state by a low temperature setting (known as hazardous cryogenic gases). Hazardous cryogenic gases (e.g., Liquefied Natural Gas and Hydrogen) are listed under the "Hazardous Gases" list located in the Appendix I of Subpart C and in Appendix C. For hazardous cryogenic gases kept in gas phase, consider ASD calculations for fire and explosion.

12. Regulation 24 CFR Part 51 Subpart C, this *Guidebook*, and the ASD assessment tool apply to HUD-assisted projects located near hazardous operations which store, handle or process hazardous substances. No provision was made for waiver of the Regulation or for waivers of the ASD standard.

13. Barriers for blast-overpressure should be constructed as close to the hazard source as possible. The barrier design, location and construction must be site specific.

14. Gasoline service stations usually do not fall within the purview of 24 CFR Part 51, Subpart C. In most gasoline service stations, the containers where the fuel is stored are underground, and underground storage containers do not apply to the Regulation. However, if a gasoline service station does have above-ground stationary containers of capacities of greater than 100 gallons that store common liquid industrial fuels (such as gasoline, fuel oil, kerosene and crude oil), then those containers would be considered under the Regulation.

15. If the ASD cannot be achieved between a hazard involving thermal radiation effects and a proposed HUD-assisted project, please refer to Chapter 5 – Mitigation Options of this *Guidebook*. If difficulties are found calculating the ASD or performing a mitigation analysis for the proposed HUD-assisted project site, contact the respective HUD Field or Regional Environmental Officer. The thermal heat flux effects on the proposal need to be calculated by a licensed professional engineer on a case by case basis, and depending on the results of the analysis, if a fire mitigation wall is required, it may not be feasible for the developer due to the size requirements to mitigate the fire ball produced by the hazard.

16. If the ASD cannot be achieved on a hazard involving blast-overpressure effects on a proposed HUD-assisted project, please refer to Chapter 5 – Mitigation Options of this *Guidebook*. If difficulties are found calculating the ASD or performing a mitigation analysis for the proposed HUD-assisted project site, contact the HUD Field or Regional Environmental Officer. Blast barriers should be designed and implemented based on the calculation of the peak positive incident pressure (blast-overpressure) produced by the hazard. The blast barrier should be implemented as close as possible to the hazard producing the blast-overpressure. Only licensed professional engineers (civil or structural) should design and implement blast barriers. Design and implementation of blast barriers is site specific.

17. The Regulation does not apply to safety requirements of employees at facilities that store, handle or process flammable or explosive substances. Such standards and guidance or safety requirements would fall within the purview of the National Fire Protection Association (NFPA), local fire codes, and permitting requirements, and the Occupational Safety and Health Administration.

Important Questions and Answers Regarding 24 CFR Part 51 Subpart C:

The following questions are often asked of HUD-Headquarters personnel regarding the regulation 24 CFR Part 51 Subpart C:

1. Are above-ground, stationary tanks that contain flammable or explosive petrochemical fuels and are ancillary to the operation of a building (e.g., comfort heating, cooking, water heating) **that is not** a 1-4 family - FHA insured property subject to the Regulation?

   Answer : Yes, unless the tanks have a capacity of 100 gallons or less and contain common liquid industrial fuels, the ASD must be calculated for above-ground, stationary tanks containing flammable or explosive petrochemical fuels ancillary to the operation of a building if is not a 1-4 family - FHA insured property.

2. Does the Regulation consider tank designs (e.g., double wall, fire resistant, protected) on the ASD calculation procedures for a proposed HUD-assisted project site?

   Answer: No, the Regulation does not consider tank designs on the ASD calculation procedures for a proposed HUD-assisted project.

3. Does the Regulation consider fire suppression systems (e.g., water, high expansion foam, Halon gas, Aqueous Film Forming Foam) as a substitute for the ASD or mitigation?

   Answer: No, the Regulation does not consider fire suppression systems as a substitute for mitigation or the ASD.

4. When should above-ground, stationary tanks containing hazardous substances be moved from a proposed HUD-assisted project in order for the project to be in compliance with the Regulation?

   Answer: The tanks must be moved before the HUD-assisted building or site is occupied or used.

5. Does the Regulation provide standards for the location of above-ground stationary storage tanks for the protection of construction workers?

   Answer: No, the Regulation does not regulate or provide standards for the location of storage tanks for the safety requirements of construction workers. Such standards and guidance or safety requirements would fall within the purview of the National Fire Protection Association (NFPA), local fire codes and permitting requirements, and the Occupational Safety and Health Administration, respectively.

6. Does the Regulation apply to protecting HUD-assisted hazardous facilities from the facility's own tanks?

   Answer: No, the Regulation does not apply to the protection of the proposed HUD-assisted industrial facility from the facility's own tanks. For a proposed HUD-assisted project involving the installation of a hazardous facility, the Department shall ensure that such hazardous facility is located at an acceptable distance from residences and from any other facility or area where people may congregate.

7. Does the Regulation apply to public facilities, such as sewer and water treatment plants that may have water tanks, underground sewer lines, and pumping facilities?

   Answer: Public facilities like the ones described above are not subject to consideration under the Regulation as it applies to above-ground stationary storage containers that hold hazardous substances. The Regulation does not generally apply to public facilities unless there are above-ground stationary containers on site that would meet the criteria contained in the Regulation.

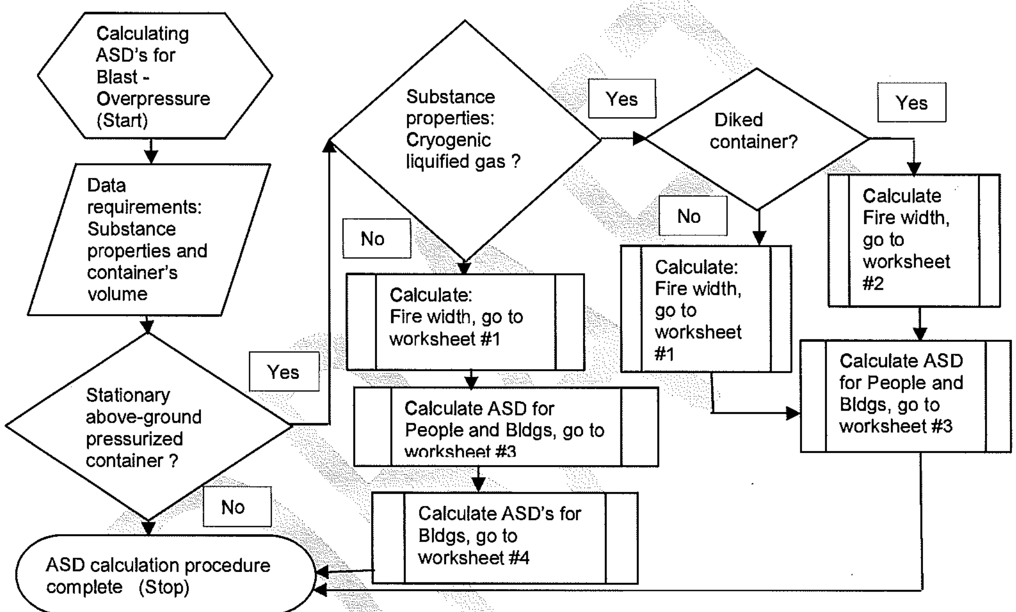
What are the steps to follow after the ASD of a proposed HUD-assisted project has been calculated?

- If the ASD meets the standard requirement, no further action is required.
- If the ASD does not meet the standard requirement, mitigation (explained in Chapter 5) may be required.
- If the ASD does not meet the standard requirement and mitigation is not possible, consult Chapter 5 (mitigation analysis #9).

Example 1: On the determination of the ASD for blast-overpressure (explosion) and thermal radiation (fire):

In this hypothetical case, a proposed HUD-assisted project is to be sited 850 feet from a stationary above-ground, 30,000 gallon liquid propane gas (LPG) container. The objective is to determine the Acceptable Separation Distance (ASD) from the proposed HUD-assisted project to the LPG container. Since LPG has flammable properties and it is under pressure (gases), the ASD must be evaluated for blast-overpressure and thermal radiation.

Follow the flowchart below for a flammable, non-cryogenic substance contained in a stationary above-ground container under pressure in order to determine the ASD for Thermal Radiation (fire) and Blast-Overpressure while knowing the substance properties and the volume of the container.



Proceed to calculate the fire width, using Worksheet 1. Use Worksheet 1 because the dike area on a pressurized container does not have any effect on the ASD calculations. Following with the procedure, the volume of the container (30,000 gallons) is plotted in the x-axis toward the line graph, making an intersection with the line graph. This intersection point is then plotted toward the y-axis, providing the fire width (see figure 1). The fire width was determined to be 350 feet.

Proceeding with ASD calculation procedures for people and buildings, use Worksheet 3. The fire width (x-axis) is plotted toward the first line graph (bottom graph), making an intersection with the graph. This intersection point is plotted toward the y-axis, providing the ASD for buildings (see figure 2). The ASD for buildings was determined to be 240 feet. Further on, the first intersection point (bottom graph), is (continued in page 33)

Figure 1: Fire Width calculation (Undiked Container)

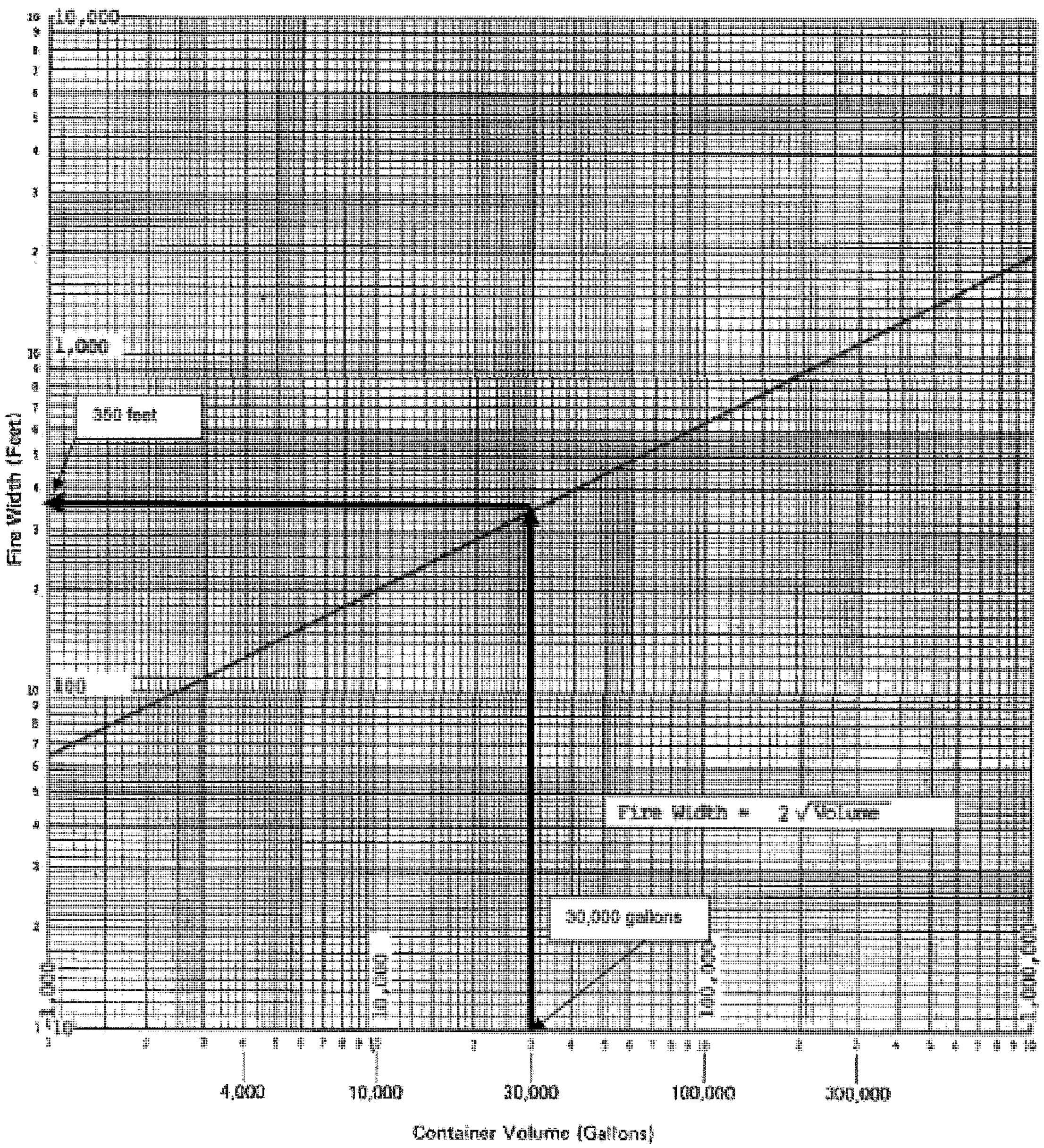
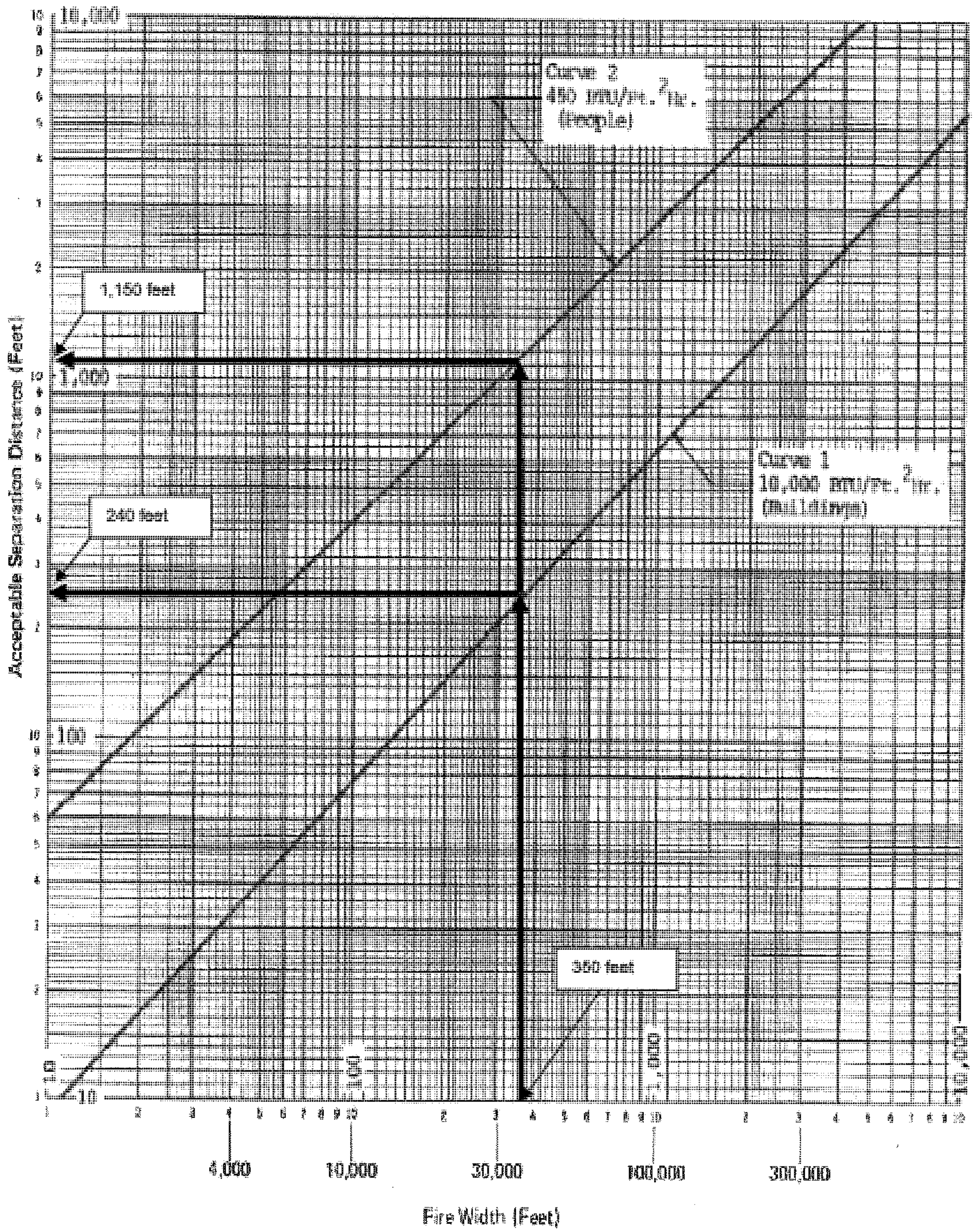


Figure 2: Acceptable Separation Distance Calculation for Buildings and People (Thermal Radiation)

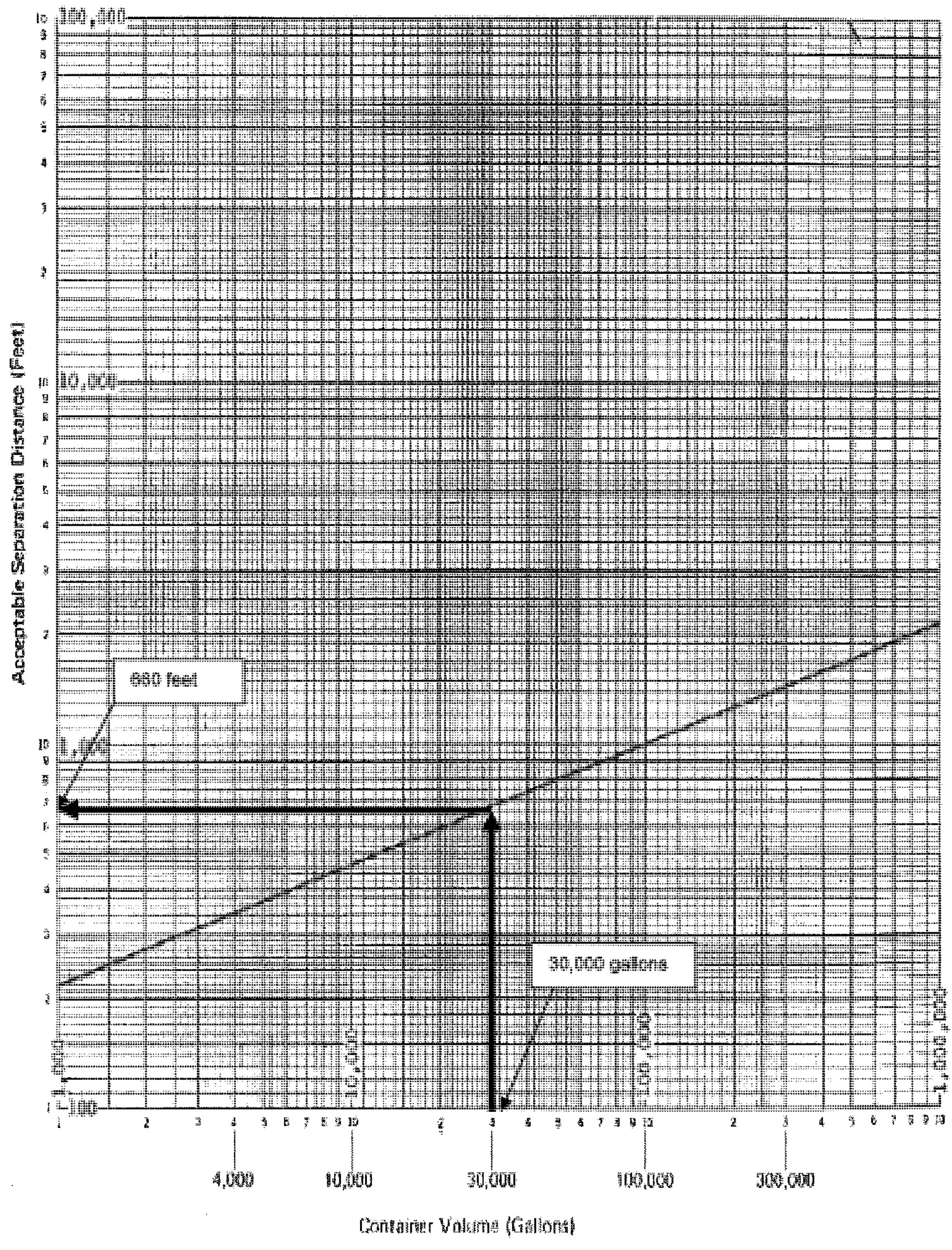


plotted toward the second line graph (top graph), making an intersection with the graph. This intersection is plotted toward the y-axis, providing the ASD for people (see figure 2). The ASD for people was determined to be 1,150 feet.

In this case, the actual distance from the center of the LPG container to the perimeter of the proposed HUD-assisted project is 850 feet. The proposed HUD-assisted project complies with the thermal radiation standard for buildings, but not for people. Since the project cannot achieve the ASD for thermal radiation for people (the ASD is 1,150, which is not within the actual distance of the proposal, measuring from the center of the LPG container), a mitigation analysis (presented and explained in detail in Chapter 5) would be required.

Since the product is contained under pressure (gases) and does have flammable properties, the ASD for blast-overpressure must be calculated. Referring to the flowchart used in this example, and knowing the volume of the LPG container (in gallons), use Worksheet 4. Plot the volume of the container (x axis) toward the line graph and make an intersection with the graph. Further on, plot this intersection toward the y axis to determine the ASD for blast-overpressure. In this case this value is 660 feet (see figure 3). This proposed HUD-assisted project complies with the blast-overpressure standard for buildings (the ASD is 660 feet, which is within the actual distance of the proposal, measuring from the center of the LPG container).

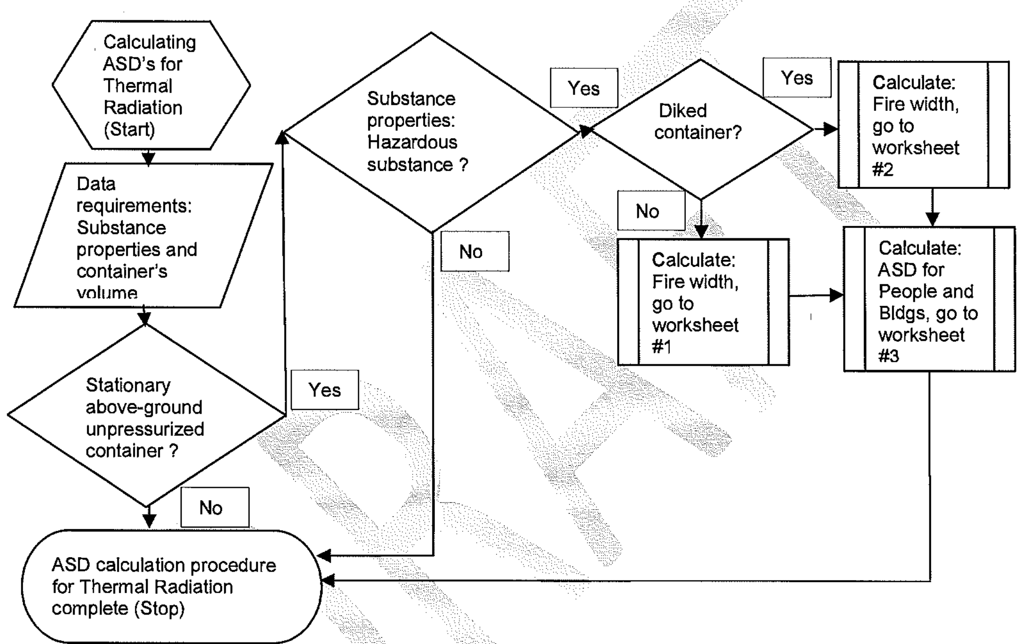
Figure 3: Acceptable Separation Distance calculation for Buildings (Blast-Overpressure) , Building Occupants and outdoor unprotected facilities



Example 2: On the determination of the ASD for thermal radiation (fire)

In this hypothetical case, a proposed HUD-assisted project is to be sited 850 feet from a diked, stationary, above-ground 30,000 gallon gasoline container. The objective is to determine the ASD from the proposed HUD-assisted project to the gasoline container. Since gasoline has flammable properties and is not under pressure (liquid), the ASD must be evaluated only for thermal radiation.

Follow the flowchart below for a hazardous substance contained in an above-ground stationary container not under pressure for the determination of the ASD for Thermal Radiation (fire), knowing the substance properties, diked area, and the volume of the container.



Knowing the diked area (**length** times the **width** in square feet) of 60,000 square feet (**200**ft times **300**ft), calculate the fire width using Worksheet 2. The diked area of the container (60,000 square feet) is plotted in the x-axis toward the line graph, making an intersection with the line graph. This intersection point is then plotted toward the y-axis, providing the fire width (see figure 4). The fire width was determined to be 235 feet.

Proceeding with calculation procedures for the ASD for people and buildings, use Worksheet 3. The fire width (x-axis) is plotted toward the first line graph (bottom graph), making an intersection with the graph. This intersection point is plotted toward the y-axis, providing the ASD for buildings (see figure 5). The ASD for buildings was determined to be 160 feet. Further on, the first intersection (bottom graph) is plotted toward the second line graph (top graph), making an intersection with the graph.

Figure 4: Fire Width calculation (Diked Container)

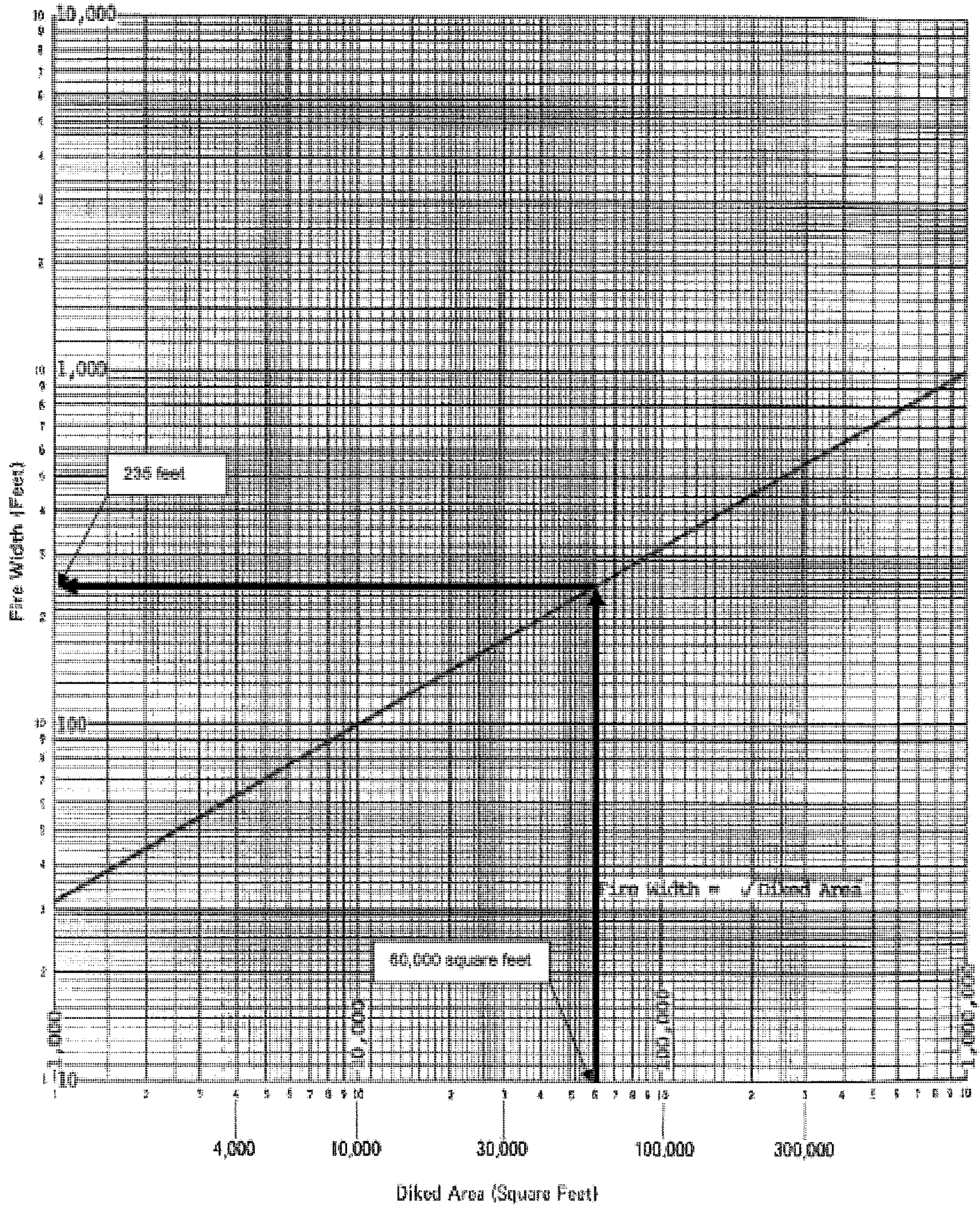
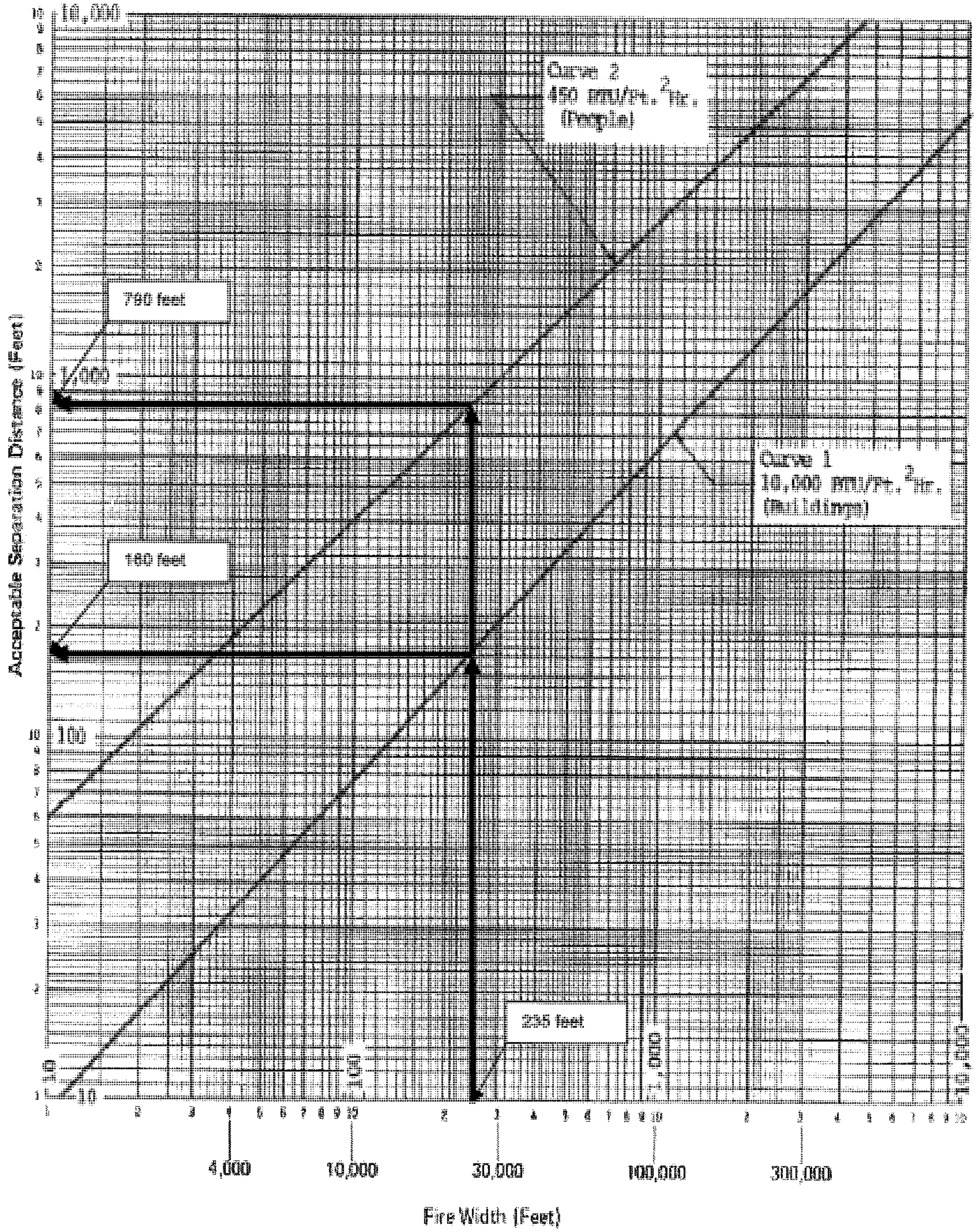
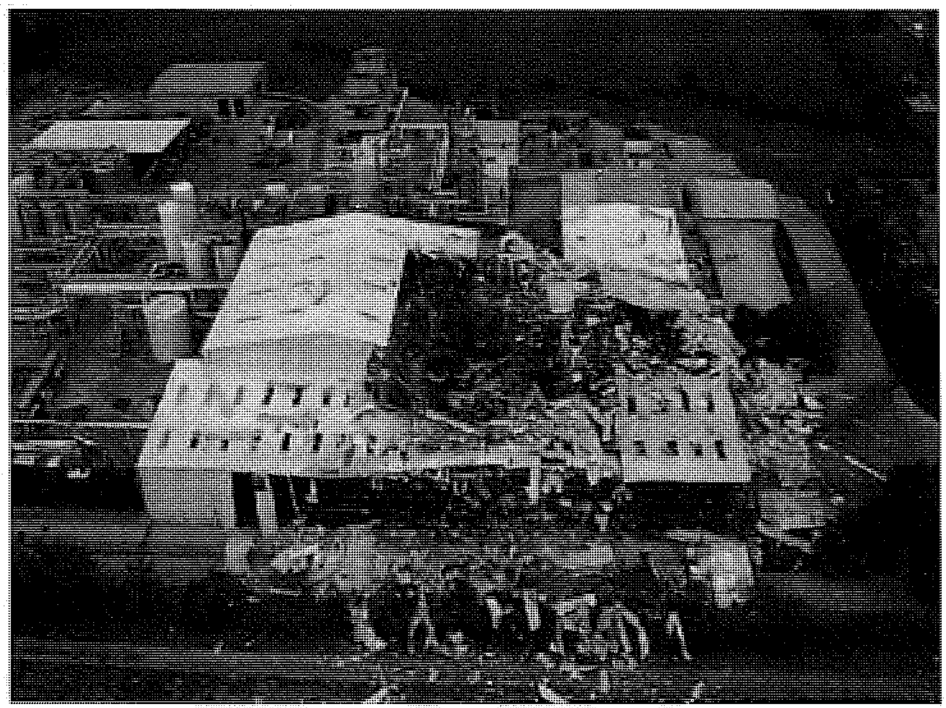


Figure 5: Acceptable Separation Distance Calculation for Buildings and People (Thermal Radiation)



This intersection is plotted toward the y-axis, providing the ASD for people (see figure 5). The ASD for people was determined to be 790 feet.

In this case, the actual distance from the center of the gasoline container to the perimeter of the proposed HUD-assisted project is 850 feet. The proposed HUD-assisted project complies with the thermal radiation standard for buildings and for people.



5. View of the aftermath of an explosion (caused by a chemical contained under pressure) at the Georgia Pacific Plant located in Ohio.

Chapter 5 – Mitigation Options

This chapter provides information about mitigation analysis and how to determine if mitigation is required on a proposed HUD-assisted project. This chapter identifies the data points and explains the analytic guidelines for a proposed HUD-assisted project, focusing on HUD standards for blast-overpressure and thermal radiation produced by stationary hazards covered under 24 CFR Part 51 Subpart C.

Mitigation is required to protect buildings and people when the ASD cannot be met between the specific stationary hazardous operation and the proposed project site. Mitigation applies only for HUD-assisted projects in proximity to stationary hazardous operations that have above-ground stationary storage containers of 1) more than 100 gallon capacity that contain common liquid industrial fuels (see Appendix I of the Regulation and Appendix C of this *Guidebook)*; and 2) of any capacity that contain hazardous liquids or gases that are not common liquid industrial fuels (see also the list of hazardous substances in Appendix C of this *Guidebook*).

<u>Mitigation analysis:</u>

The best mitigation is based on site analysis using the following 11 questions:

1. **Has the Acceptable Separation Distance (ASD) been calculated?**

   If the ASD has not been calculated, then calculate the ASD. The ASD is the first step of the mitigation analysis for HUD-assisted projects near hazardous operations that store, handle or process flammable or explosive substances.

   If the ASD has been calculated, two results are possible: 1) The ASD is achievable using the proposed site and no further action required, or 2) The ASD is not achievable using the proposed site and so mitigation may be required.

2. **Where is the technical information for the ASD determination available?**

   Technical assistance is available from the following sources:

   - This guidebook,
   - Regulation 24 CFR Part 51 Subpart C, and
   - HUD field environmental staff (Regional Environmental Officers and Field Environmental Officers)

3. **What properties make the substances stored at the site hazardous?**

   Substances in general are classified as liquids, solids or gases. The physical state of matter of existent substances are in liquid, gas or solid form. Gases are stored under pressure, liquids cannot be compressed and take the form of the storage container in question. Solids are incompressible and have a solid structure.

   If the substances being assessed are hazardous and/or have blast-overpressure properties and are in stationary above-ground containers, a hazardous analysis is required for the proposed HUD-assisted project site. For ASD determination and mitigation hazard analysis of a proposed HUD-assisted project site, only hazardous liquids or gases and/or blast-overpressure properties are considered. Pressurized containers with hazardous substances, if ruptured, can cause steam gas explosions or gas explosions. For products (substances) stored under pressure, two results are possible:

- Blast-overpressure or pressure wave
- A fireball accompanied by a pressure wave (blast-overpressure)

4. **What differences are there between a diked and an undiked container?**

If containers are diked:

- The ASD calculation will not be changed by the diked area on pressurized containers (hazardous substances); and
- The ASD will be of a smaller numerical value for diked containers vs. undiked containers storing hazardous liquids.

If containers are undiked:

- The ASD will be of a larger numerical value for undiked containers vs. diked containers storing hazardous liquids.

(Chapter 4 includes calculation guidelines and facts for pressurized and non-pressurized containers.)

5. **What role does topography have in influencing ASD calculations? Do natural or man-made barriers between the proposed HUD-assisted project and the hazard make a difference?**

Natural barriers are hills, mountains, earthen elevations, etc. Man made barriers are buildings, housing developments and other structures. Natural and man-made barriers may serve as abatement from thermal radiation or blast-overpressure effects that can have an impact on HUD-assisted projects and the people who live and work there.

If there are natural or man-made barriers between the proposed HUD-assisted project site and the hazard, the available barrier must serve to abate the effects of thermal radiation, blast-overpressure or both from the hazard.

The following points provide valuable information to evaluate the available barrier between the proposed HUD-assisted project and the hazard:

- Man-made or natural barriers may serve to abate the effects of thermal radiation or blast-overpressure on HUD-assisted projects and the people who live and work there.
    - If the ASD is not achievable between the proposed HUD-assisted project site and the hazardous operation/facility, but there is no clear line of sight between the proposed HUD-assisted project and the hazard, mitigation may not be required. Under the regulation 24 CFR Part 51 Subpart C, if there is a natural or man-made abatement between the proposed HUD-assisted project

and the hazard that impedes a clear view, the abatement might serve as mitigation for the proposed HUD-assisted project.

- If it has been determined that mitigation may not be required using the above mentioned analysis, the natural or man-made abatement must be further analyzed to ensure it will provide an acceptable level of mitigation for the proposed HUD-assisted project site. Only a licensed professional engineer should analyze and confirm the acceptability of preexisting barriers based on the hazard being analyzed.

- If the ASD is not achievable between the site to be developed and the hazard and there is a clear line of sight between the proposed HUD-assisted project and the hazard, mitigation is required.

If there are no natural or man-made barriers between the proposed HUD-assisted project site and the hazard and the ASD is not achievable, there are mitigation options described in this *Guidebook* to achieve abatement and compliance with HUD standards.

6. **Where can I get maps or other geographic information?**

- Sources of information:

  i. Maps and related site (topographic) information are available from the United States Geological Survey (USGS), City or County engineer's or planning office related to the proposed HUD-assisted project.

  ii. Although HUD does not endorse these sources, free digitized topographic maps and other relevant information can be found at

     a. Yahoo Maps, http://developer.yahoo.com/maps/
     b. Google Earth, http://earth.google.com/

- Types of information:

  i. Scaled maps with site contours (topographic maps) are highly recommended for the analysis of proposed HUD-assisted project sites.

  ii. Site maps similar in content to the scaled maps, but without site contours, are recommended as an initial type of geographic based information for analysis of proposed HUD-assisted project sites.

  iii. Site photos provide actual images of the facilities near proposed HUD-assisted project sites and are recommended for use with scaled and site maps for the analysis of proposed HUD-assisted project sites.

7. **What sources can I use if the facility storing these hazards will not release subject information?**

   - Fire Department: the local fire department can provide information about facilities and operations

   - Local Emergency Planning Committee Database: the governor of each state has designed a State Emergency Response Commission Contact (SERC) whose responsibility is to implement the Emergency Planning Community Right to Know Act (EPCRA) provisions within that State. The SERC supervises and coordinates the activities of the Local Emergency Planning Committee (LEPC) for each district, establishes procedures for receiving and processing public requests for information collected under EPCRA, and reviews local emergency response plans. The local LEPC database for public use can be found at

     http://YOSEMITE.EPA.GOV/OSWER/LEPCDB.NSF/SearchfORM?OpenForm

8. **Fire suppression systems, used along with sirens and fire alarms for protection of buildings and people, are designed to extinguish fires by automatically discharging fire suppressing media (e.g., water, high expansion foam, Halon gas) at areas that require fire protection.**

   - Can fire suppression systems modify or change the analysis to obtain Acceptable Separation Distances (ASDs)?
     - No (not at this time).

   - Can fire suppression systems modify or change the analysis as an alternative to ASDs?
     - Neither the Regulation, the *Guidebook* nor the ASD assessment tool consider the use of fire suppression systems as an alternative or modification to ASDs or as part of the ASD analysis.

9. **What are the options if you cannot achieve the ASD?**

   In addition to a barrier, other options include:

   - Burying the hazard, an alternative that is often less expensive than building a mitigation barrier.

   - Modifying the building design to compensate for the ASD. The building design can be modified by using heat retardant and high tensile strength materials in the direction where the hazardous facility is located in order to compensate for the ASD. Buildings can also be re-arranged and their exterior shapes modified. A combination of these approaches may be used to provide an acceptable level of mitigation (e.g., a horseshoe-shaped building can be oriented with the convex curve facing the hazard and the structure augmented with heat retardant and tensile strength materials).

   - Choosing a different site.

- Resorting to a barrier.

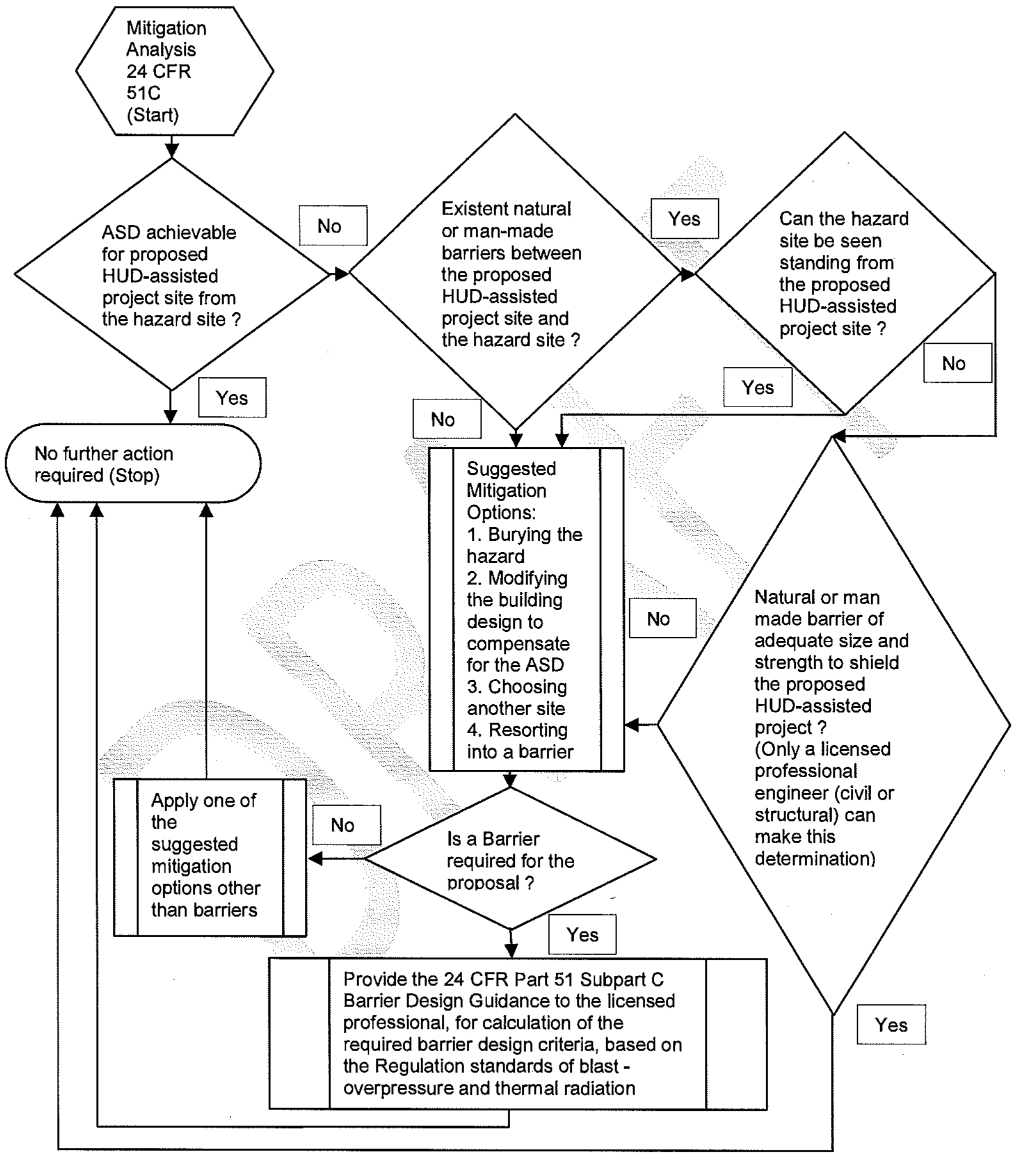
10. How does a barrier work?

- A barrier works as an abatement for thermal radiation and blast-overpressure and provides mitigation to HUD-assisted projects when the Acceptable Separation Distance (ASD) is not achievable.

11. Who should design a barrier?

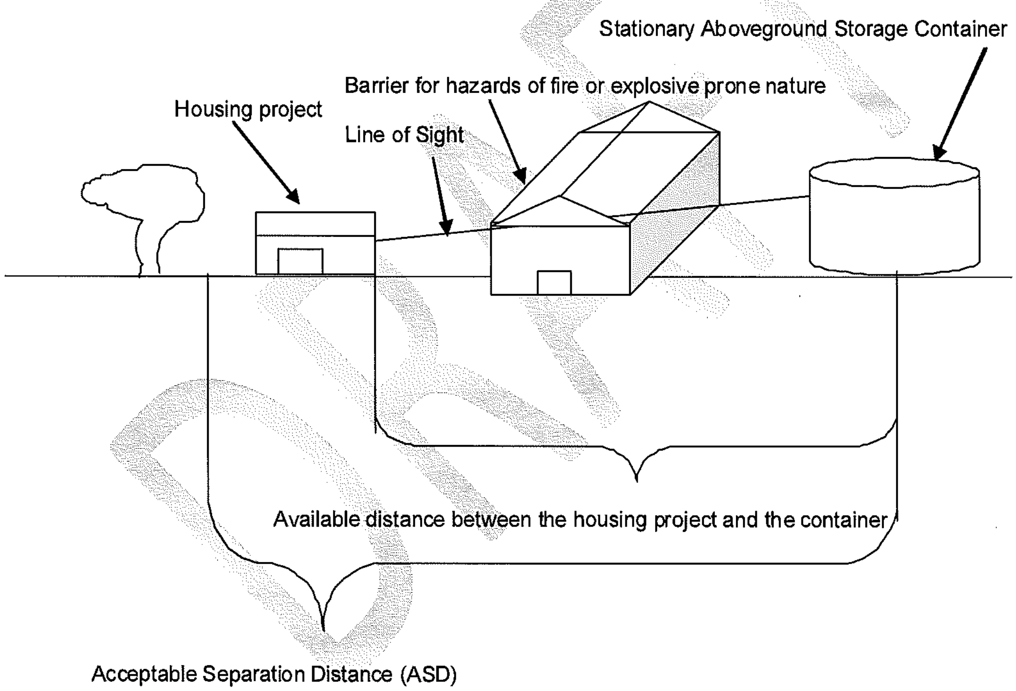
- Only a licensed professional engineer (civil or structural) should design and oversee the construction of mitigation barriers

Flowchart illustrating a mitigation analysis for a proposed HUD-assisted project site

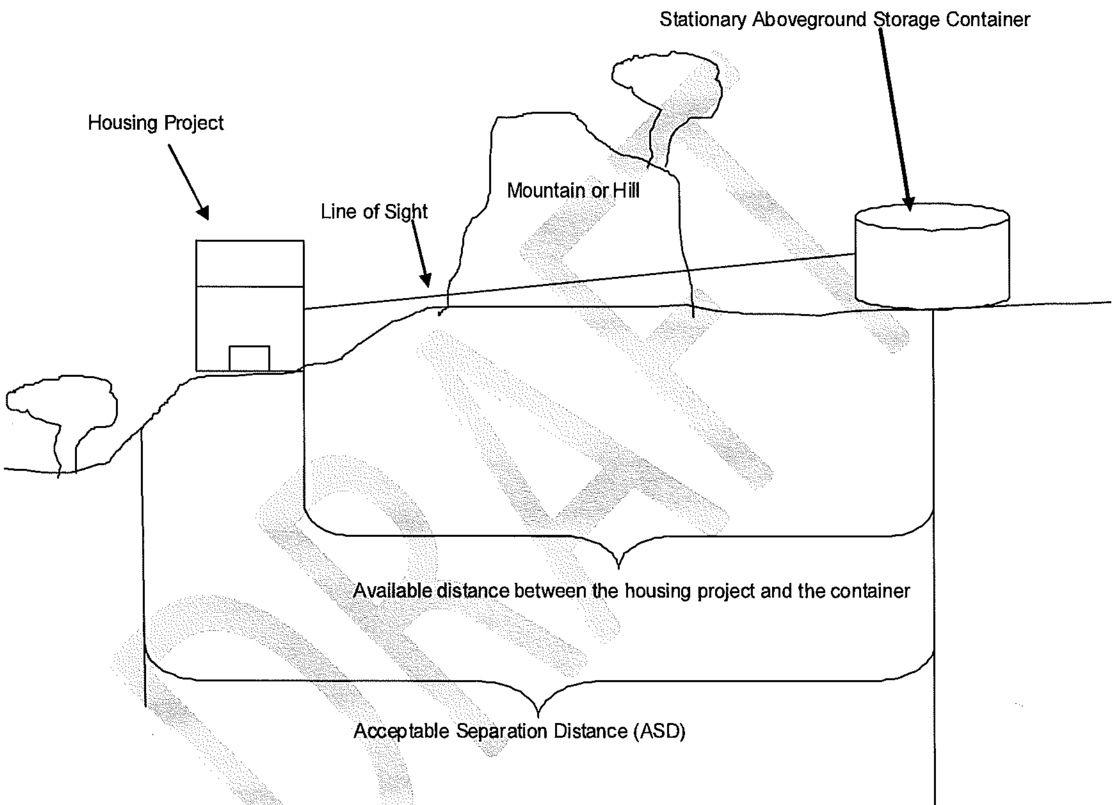


The following scenarios illustrate mitigation options involving natural and man-made barriers if the ASD cannot be achieved between the proposed HUD-assisted project and the hazard being assessed.

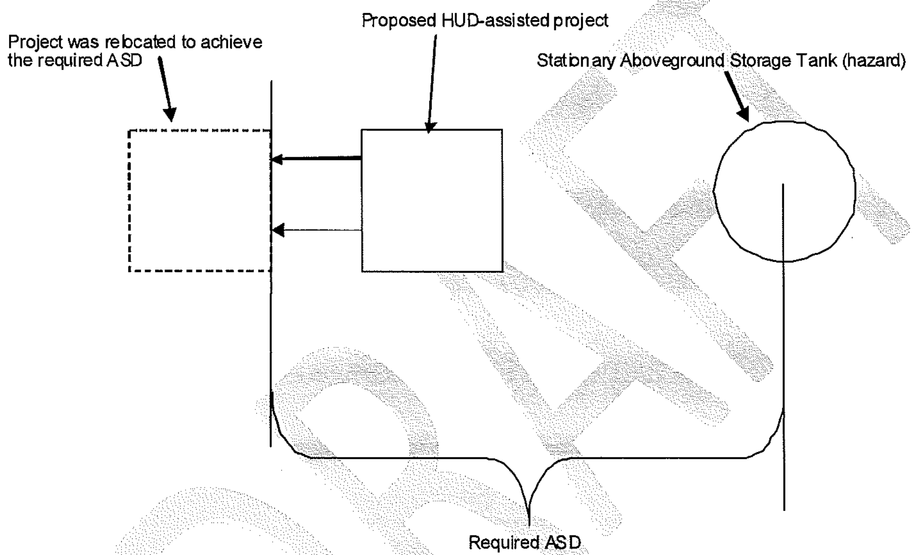
Scenario 1: A man-made barrier (warehouse) is located between a proposed housing project and a stationary above-ground storage tank as a mitigation measure, following the regulation 24 CFR Part 51 Subpart C.



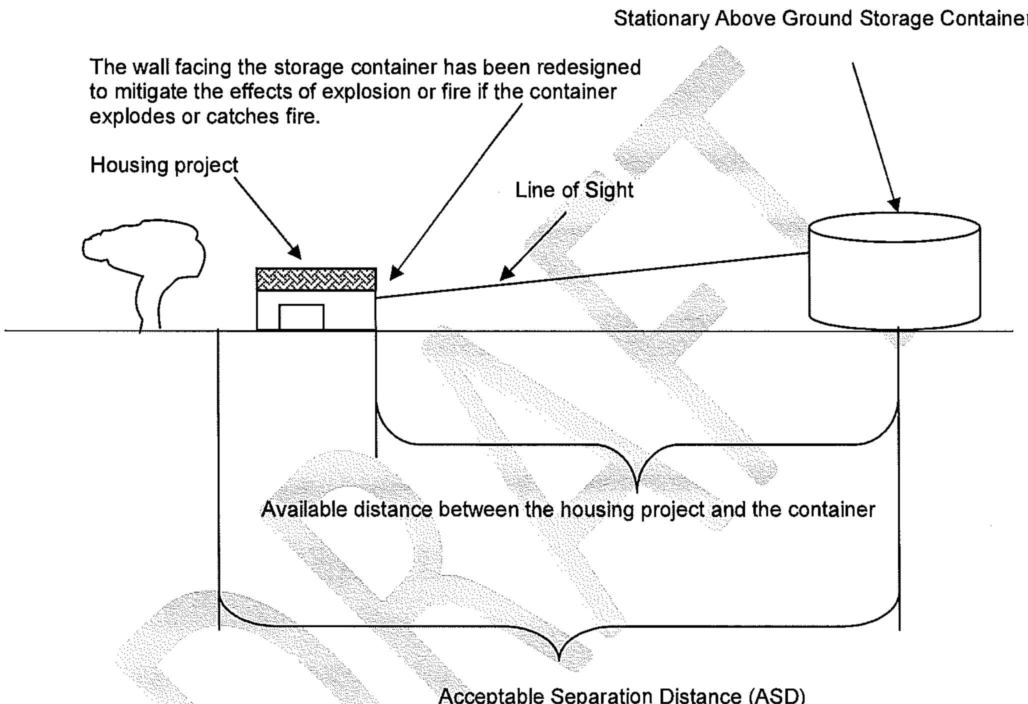
Scenario 2: A natural barrier (mountain or hill) is located between a proposed housing project and a stationary above-ground storage tank, providing mitigation to the housing project if the tank explodes or catches on fire.



Scenario 3: Reconfigure/relocate proposed HUD-assisted project to increase the available distance between the project and the hazard and achieve the required Acceptable Separation Distance (ASD) in accordance with the regulation 24 CFR Part 51 Subpart C.



Scenario 4: Modification of the building design to compensate for the ASD.



6. The aftermath of the January 10, 2008 propane blast near a unit townhouse complex in Brampton, California. More than a dozen propane containers had been stored near the townhouse complex.

Chapter 6 – Extraordinary Circumstances

This chapter identifies extraordinary circumstances which, due to a proposal's complexity, require consultation with HUD-Regional and Field Environmental Officers and additional information and procedures that are not provided in the regulation 24 CFR Part 51 Subpart C. Applicants for HUD funding assistance must comply with the standards and the Acceptable Separation Distance (ASD) stipulated under the Regulation between specific stationary hazardous facilities that store, handle, or process hazardous substances.

Standards under 24 CFR Part 51.203:

- Thermal Radiation, 10,000 BTU/ft^2 - hr
    - Applicable to buildings

- Thermal Radiation, 450 BTU/ft^2 – hr
    - Applicable to people

- Blast Overpressure, 0.5 psi
    - Applicable to buildings, building occupants and outdoor unprotected facilities

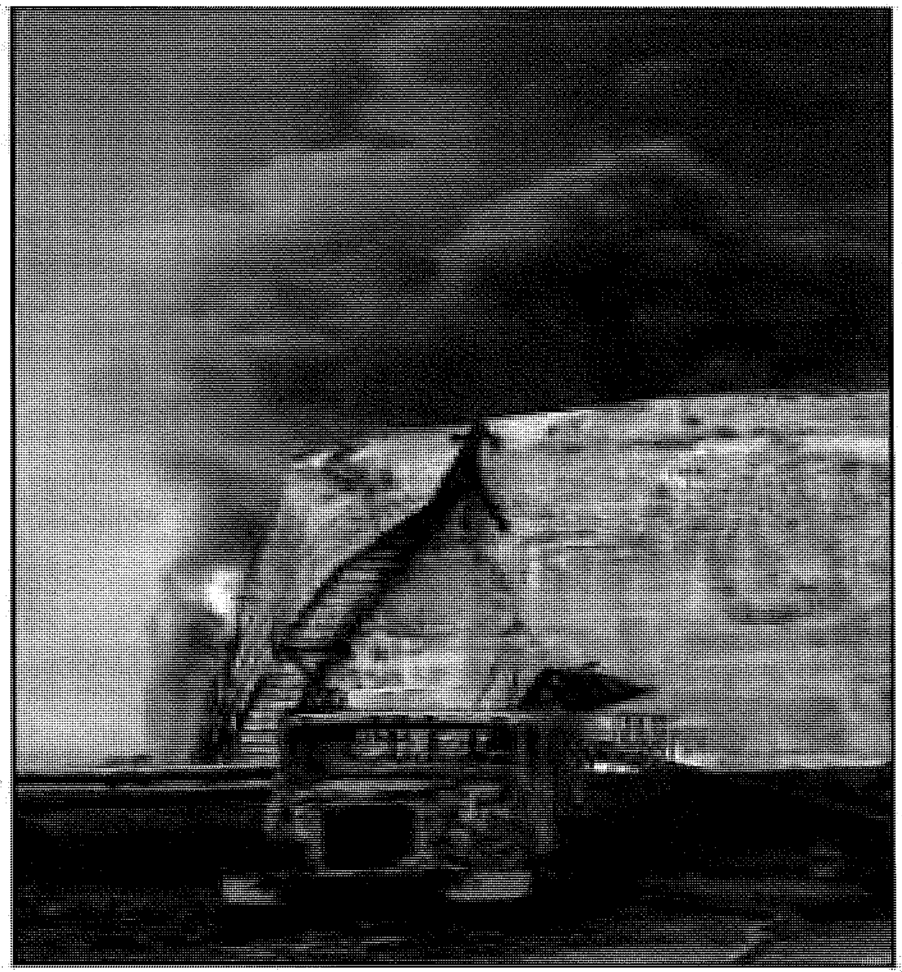
Extraordinary circumstances include:

- Analysis of containers that hold hazardous substances (liquids or gases) not listed in Appendix I of the Regulation or in Appendix C of this Guidebook in close proximity to proposed HUD-assisted projects.

- Analysis of existing natural or man-made barriers that may serve as mitigation for HUD-assisted projects from flammable or explosive hazards.

- Calculation of design specifications for barriers used to mitigate flammable and explosive hazards that are located near proposed HUD-assisted projects.

Every proposed HUD-assisted project is different. Therefore, each one should be analyzed according to site conditions such as container size and location, and proximity to residential structures, etc. Mitigation and/or safety measures may be required at some sites, but only suggested at others.



7. Firefighters extinguishing fires from jet fuels tanks that were burning out of control at Apra Harbor, Guam.

FM Global Property Loss Prevention Data Sheets 7-0 (April 2013)
Causes and Effects of Fires and Explosions

CAUSES AND EFFECTS OF FIRES AND EXPLOSIONS

Table of Contents

List of Figures

List of Tables

1.0 SCOPE

This data sheet is designed to provide information useful to those evaluating fires and explosions. It does not include recommended safeguards.

Refer to Data Sheet 7-42, *Guidelines For Evaluating the Effects of Vapor Cloud Explosions Using a Flame Acceleration Model,* for specific details on outdoor vapor cloud explosions and methods to evaluate the blast effects on property.

1.1 Changes

April 2013. Minor editorial changes and additional guidance for using TNT equivalence methods for estimating the effects of explosions (overpressure) involving energetic materials.

2.0 GENERAL

With fire, two factors are of major importance. These are the cause or ignition source and the development of the fire. Determination should be made as to how fire could start and how it could develop, spread, be controlled, and extinguished.

In an explosion, events prior to explosion are important. An explosion is a rapid transformation of potential physical or chemical energy into mechanical energy. It is important to determine how the potential energy can be accumulated or prepared for sudden transformation and how this transformation can be triggered. The effects of an explosion may be explored to evaluate its magnitude.

3.0 BASIC DEFINITIONS AND PRINCIPLES—FIRE

3.1 Combustion

Combustion is an exothermic chemical reaction usually involving oxidation of a fuel by atmospheric oxygen. Glowing combustion involves direct oxidation of a solid or liquid fuel, such as charcoal or magnesium. Flaming combustion involves a gas phase or volatile matter driven off by heat.

3.2 Ignition Temperature

Ignition temperature is the minimum temperature to which a substance must be heated to initiate self-sustained combustion in whatever atmosphere is present. To start the chemical reaction between fuel molecules and oxygen molecules, sufficient energy must be imparted into the mix. If the fuel is a solid or liquid, some of it usually is turned into a gas (unless the oxidizer is also a solid or liquid) so that there is intimate mixing of molecules. The ignition temperature can vary, depending on the fuel or oxygen concentration, the rate of air flow, rate of heating, the size and shape of the solid or space involved, the temperature of the ignition source, and possible catalytic or inhibiting effect of other materials present.

For less volatile solids, such as wood, or paper, the ignition temperature is greatly dependent on the time necessary to volatilize the fuel to form an ignitable mix at the surface. Artificial heating can also initiate self-heating, which may bring the fuel up to its ignition temperature. The normally accepted minimum self-ignition temperature of wood, paper, cotton, wool, and combustible fiberboards is 400° to 500°F (200° to 260°C). Ignition can occur at lower temperatures if the material is contaminated with oils or if charcoal is formed followed by ensuing self-heating.

4.0 IGNITION SOURCES

An ignition source is normally energy in the form of heat which brings fuel up to its ignition temperature. Since fires are unusual in most occupancies, an ignition source usually involves some unusual circumstance not otherwise present. Ignition sources are classified based on the origin of the heat involved.

4.1 Electrical

Electrical energy produces heat when electric current flows through a conductor or jumps an air gap. The heat produced is proportional to the resistance and to the square of the current. Excessive heat, sufficient to start a fire, can be generated by: (1) a high current, (2) a high resistance, or (3) impaired cooling or removal of normal heat.

1. High current can be the result of:

   a. Short circuits caused by breakdowns in insulation or accident. Continuous overload causing a short before the fire will exhibit beads of metal and fusing of the copper wire conductors. There will also be decomposition and carbonization of insulation on both sides where the short occurred. Shorts caused during the heat of the fire may show beading. However, decomposition and carbonization of insulation will be found only on the side exposed to the fire.

   b. Single phasing in three-phase motors. (See Data Sheet 5-18, *Protection of Electrical Equipment*.)

   c. Loss of field in synchronous motors. (See Data Sheet 5-13, *Synchronous Motors*.)

   d. Lightning. (See Data Sheet 5-11, *Lightning Surge Protection*.)

2. High resistance can be the result of loose or oxidized electrical connections.

3. Impaired cooling can be the result of:

   a. Failure of fans in transformers or enclosed equipment.

   b. Plugging of air passageways.

   c. Coatings on bare wires, bus bars, lighting fixtures, and heating elements.

   d. Dropping of oil or other coolant levels away from heating elements.

   e. Combustibles too close to light bulbs or heating elements.

When electric current jumps an air gap, the resistance is so high that even a small current produces significant energy. In the case of static sparks, minute currents can ignite flammable vapors or gases. Strong currents arcing across air gaps can melt metal, which in turn can start fires.

If electric motors are found in the area of origin, check the interior of the motor windings to see if the fire was deep seated; the wire coating at the interior would probably not burn away unless the wiring was heated electrically.

In any electrical appliance having a thermal control, sticking or fusing of the contact points would signify overheating of the device.

4.2 Static Electricity

Fires and explosions are often attributed to static electricity after other possible causes have been eliminated. If a fire or explosion is caused by static electricity, it is important to understand and explain the specific mechanism so that repetition can be prevented.

For static electricity to be a source of ignition, four conditions must be fulfilled:

1. There must be an effective means of static generation.

2. There must be a means of accumulating the charges and maintaining a suitable electrical potential difference.

3. There must be a spark discharge of adequate energy.

4. The spark must occur in an ignitable mixture.

Static is normally generated by movement of dissimilar substances involving the making and breaking of contact of surfaces. A poor conductor of electricity must be involved. Examples are a rapidly moving rubber belt; paper or cloth unwinding or passing over rollers; nonconducting fluids flowing through pipes or being agitated in tanks; or the movement of dust or stock, as in grain handling.

A free charge on an ungrounded conductive body is mobile, and the entire charge can be drawn off by a single spark. On the other hand, the charge on a nonconductive body is relatively immobile so that a spark from its surface can release the charge from only a limited area and will usually not involve enough energy to produce ignition. Thus, nonconductors, the bodies most directly involved in charge generation, are usually not directly involved in the sparks which initiate fires and explosions.

For example, if a person walks across a fur rug, static electricity will be generated by the nonconductor, the rug, and accumulated in the body of the person, a nongrounded conductor. When the person touches a grounded object, a spark will jump at that point.

A static spark is a relatively weak ignition source. The most common ignitable mixture is a mixture of a flammable vapor or gas with air. A liquid involved normally must be above its flash point. Combustible dust mixtures may possibly be ignited by static electricity, but it requires a very high energy spark. Static sparks do not normally have sufficient energy to ignite dusts.

4.3 Hot Surfaces—Nonelectrical

Combustible or flammable material may be ignited by contact with or by radiant heat from surfaces heated by means other than electrical energy. These hot surfaces are most often produced by: (1) friction, (2) heating equipment, and (3) molten substances.

1. Friction can be caused by improperly lubricated bearings, broken or misaligned machine parts, choking or jamming of materials, and poor adjustment of conveyors or machine drives. Frictional heating may cause noncombustible parts to become hot and ignite nearby combustibles. A typical example is a hot paper machine bearing igniting oil or paper lint. In some instances, the combustible material may be heated directly, as with a rubber conveyor belt slipping on a pulley.

Friction, as a fire cause, will be indicated if the point of damage to the motor belts is worse where it passes over pulleys. In fires from outside sources, belts are damaged most between pulleys.

2. Heating equipment located too close to combustible construction or storage can result in ignition. The top or bottom of a furnace or heater, a hot flue or duct, or an exposed steam pipe may ignite combustibles in contact with the heated surface or where nearby clearances, insulation, or air circulation is adequate.

The ordinary ignition temperature of wood is 400° to 500°F (200° to 260°C), but when wood is exposed to prolonged heat, it undergoes a chemical change and becomes pyrophoric carbon with an ignition temperature as low as 300°F (150°C). Heat will greatly reduce the time required for ignition. For instance, long leaf pine will ignite when subjected to: 356°F (180°C) for 14.3 minutes; 392°F (200°C) for 11.8 minutes; 437°F (225°C) for 8.7 minutes; 482°F (250°C) for 6.0 minutes; 572°F (300°C) for 2.3 minutes; 662°F (350°C) for 1.4 minutes; and 752°F (400°C) for 0.5 minutes.

3. Molten substances, such as metal or glass escaping from a furnace or container, can ignite any combustible material in the vicinity.

4.4 Sparks and Open Flames—Hot Work

Open flames may be fixed or portable. Fixed open flames, such as in ovens, furnaces, water heaters, and boilers, may ignite moving combustibles, such as flammable vapors or gases. Portable flames, such as portable burners or welding torches, can ignite combustible material any place in a building. Hot sparks or molten globules from cutting or welding or from mechanical grinding operations are common ignition sources. Metal introduced into textile or grain processing machinery can generate hot sparks that can ignite lint, dust, or other easily ignitable material.

4.5 Smoking

Smoking is a leading cause of fires. This conclusion is often determined by a process of elimination. Direct evidence is seldom found which proves that a cigarette, cigar, or match was specifically the ignition source.

Studies have been made of the mechanisms by which cigars and cigarettes start fires. Temperatures in a glowing cigarette range from 550° to 1400°F (290° to 760°C). Test conclusions were:

1. Cigars and cigarettes start fires in solid fuels (except explosives, matches, and other highly flammable chemicals) by first initiating glowing combustion. Therefore, in order to be ignitable by a cigarette, a solid must be capable of supporting flameless combustion. Such materials are virtually all of cellulosic origin and include

paper, fabric, textile fibers, and dry vegetation. Materials which melt when heated, such as rubber, plastic, and most synthetic fibers, cannot sustain glowing combustion, possibly because the heat applied is absorbed as heat of fusion during the melting stage.

2. Conditions favoring ignition include a good supply of finely divided, fairly compact fuel and a good air supply or draft to promote flaming combustion.

3. Flammable vapors and gases are surprisingly difficult to ignite with a cigar or cigarette, but not impossible.

Cigarettes are an unreliable source of ignition, but their widespread use and careless handling make them significant as a fire cause. Of course, flames from matches or lighters are much stronger and more reliable ignition sources.

4.6 Incendiarism

An incendiary fire is often characterized by a conscious attempt to insure that the fire is severe. Ignitable liquids or "trailer" devices are often used to help spread the fire. Strong ignition sources are used, usually with a timing mechanism such as a candle or clock. More than one fire is often started at once. Fire protection systems may be shut off. In accidental fires, chance plays an important part. In intentional fires, chance is minimized.

Witnesses to the fire in its early stages can often give helpful information concerning the material initially involved in the fire. If incendiarism is suspected, the type of smoke or flame initially observed is often of interest.

Color of smoke is often the first clue to the combustibles involved in the fire (Table 1).

Table 1. Color of Smoke Produced by Burning Combustibles

Combustible	*Color of Smoke*
Hay/Vegetable compounds	White
Cooking oils	Brown
Phosphorus	White
Nitrocellulose	Yellow-Brownish-Yellow
Sulfur	Yellow-Brownish-Yellow
Sulfuric, nitric, or hydrochloric acid	Yellow-Brownish-Yellow
Gunpowder	Yellow-Brownish-Yellow
Chlorine gas	Greenish-Yellow
Petroleum products	Black
Wood	Gray-Brown
Most plastics	Black
Paper	Gray-Brown
Cloth	Gray-Brown

The absence of flames or comparatively small flames indicate a lack of air. More flames than smoke indicate well-ventilated burning of dry substances. Erratic flames indicate the presence of gases, while sparks in large quantities indicate that powdery substances are burning.

A trailer (a line of paper rags or ignitable liquid designed to cause a fire to spread) often leaves residue, or a fire spreads in ways other than its usual upward direction.

4.7 Spontaneous Ignition

Spontaneous heating can occur in many types of materials including solids (wood chips, coal, foam rubber, rags, fiberboard, and metal powders) and liquids (animal and vegetable oils). Materials that spontaneously heat will increase in temperature without taking heat from the surrounding environment. Heat generations is generally due to one or a combination of the following exothermic reactions (reactions that liberate heat): oxidation (chemical combination of a material with oxygen), decomposition (material breaks down into its elements), polymerization (combination of low molecular weight molecules into a single high molecular weight compound), or biological action (bacterial caused decomposition). These reactions often occur normally (at a slow rate) without heat build-up. An increase in material temperature occurs when heat loss to the surroundings is reduced. The conditions that will affect spontaneous heating include: the geometry of the material, the available surface area and insulation from the surrounding environment. Various arrangements of the above reactions and other conditions will permit spontaneous heating to occur and lead to the ignition of the material producing either flaming or smoldering combustion.

In agricultural crops, bacteria can promote oxidation and heat generation. This can be promoted by a high moisture content. The bacteria tends to die at temperatures above 160° to 175°F (71° to 80°C); heating beyond that point is normally due to oxidation accompanied by chemical decomposition.

The following materials are most subject to spontaneous heating:

1. *Animal and Vegetable Oils.* These oils contain unsaturated bonds, having greater tendency for oxidation at lower temperatures. The greatest danger occurs if they impregnate rags or other absorbent, insulating organic materials.

2. *Agricultural and Animal Products.* These may contain animal or vegetable oils, or may be subject to bacterial oxidation. If heated, or if already charred, the oxidation tendency is increased.

3. *Wood Chips.* See Data Sheet 8-27, *Storage of Wood Chips* and Data Sheet 7-10, *Wood Processing and Woodworking Facilities.*

4. *Coal and Charcoal.* See Data Sheet 8-10, *Coal and Charcoal Storage.*

5. *Fiber Products.* These products are most hazardous when heated and stored before cooling, or when impregnated or contaminated with animal or vegetable oils.

6. *Paint and Paint Scrapings.* The most hazardous are paints which are not fully dry and contain linseed oil or drying agents. High gloss paint designed to dry at room temperature contains drying agents. These oxidizing catalysts strongly promote spontaneous heating when arranged so that heat cannot readily dissipate as in stored scrapings. See Data Sheet 7-27, *Spray Application of Ignitable and Combustible Materials.*

Table 2, Materials Subject to Spontaneous Heating, lists additional materials that should be evaluated.

Table 2. Materials Subject to Spontaneous Heating[1]
(Originally prepared by the NFPA Committee on Spontaneous Heating and Ignition which has been discontinued. Omission of any material does not necessarily indicate that it is not subject to spontaneous heating.)

Name	*Tendency to Spontaneous Heating*	*Usual Shipping Container or Storage Method*	*Precautions Against Spontaneous Heating*	*Remarks*
Alfalfa Meal	High	Bags, bulk	Avoid moisture extremes. Tight cars for transportation are essential	Many fires attributed to spontaneous heating probably caused by sparks, burning embers, or particles of hot metal picked up by the meal during processing. Test fires caused in this manner have smoldered for 72 hours before becoming noticeable.
Burlap Bags "Used"	Possible	Bales	Keep cool and dry.	Tendency to heat dependent on previous use of bags. If oily would be dangerous.
Castor Oil	Very slight	Metal Barrels, Metal Cans in Wooden boxes	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Possible heating of saturated fabrics in badly ventilated piles.
Charcoal	High	Bulk, Bags	Keep dry. Supply ventilation.	Hardwood charcoal must be carefully prepared and aged. Avoid wetting and subsequent drying.
Coal, Bituminous	Moderate	Bulk	Store in small piles. Avoid high temperatures.	Tendency to heat depends upon origin and nature of coals. High volatile coals are particularly liable to heat.

Name	*Tendency to Spontaneous Heating*	*Usual Shipping Container or Storage Method*	*Precautions Against Spontaneous Heating*	*Remarks*
Cocoa Bean Shell Tankage	Moderate	Burlap Bags, Bulk	Extreme caution must be observed to maintain safe moisture limits.	This material is very hygroscopic and is liable to heating if moisture content is excessive. Precaution should be observed to maintain dry storage, etc.
Coconut Oil	Very slight	Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Only dangerous if fabrics, etc., are impregnated.
Cod Liver Oil	High	Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Impregnated organic materials are extremely dangerous.
Colors in Oil	High	Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	May be very dangerous if fabrics, etc., are impregnated.
Copra Corn-Meal Feeds	Slight High	Bulk Burlap Bags, Paper Bags, Bulk	Keep cool and dry. Materials should be processed carefully to maintain safe moisture content and to cure before storage.	Heating possible if wet and hot. Usually contains an appreciable quantity of oil which has rather severe tendency to heat.
Corn Oil	Moderate	Barrels, Tank Cars	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Dangerous heating of meals, etc., unlikely unless stored in large piles while hot.
Cottonseed Cottonseed Oil	Low Moderate	Bags, Bulk Barrels, Tank Cars	Keep Cool and Dry. Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Heating possible if piled wet and hot. May cause heating of saturated material in badly ventilated piles.
Distillers' Dried Grains with oil content (Brewers' grains)	Moderate	Bulk	Maintain moisture 7 percent to 10 percent. Cool below 100°F (38°C) before storage.	Very dangerous if moisture content is 5 percent or lower.
(Ditto) No oil content	Moderate	Bulk	Maintain moisture 7 percent to 10 percent. Cool below 100 °F (38°C) before storage.	Very dangerous if moisture content is 5 percent or lower.
Feeds, various	Moderate	Bulk, Bags	Avoid extremely low or high moisture content.	Ground feeds must be carefully processed. Avoid loading or storing unless cooled.
Fertilizers Organic, inorganic, combination of both matter	Moderate	Bulk, Bags	Avoid extremely low or high moisture content.	Organic fertilizers containing nitrates must be carefully prepared to avoid combinations that might initiate heating.
(Ditto)Mixed, Synthetic containing nitrates and organic	Moderate	Bulk, Bags	Avoid free acid in preparation.	Insure ventilation in curing process by small piles or artificial drafts. If stored or loaded in bags, provide ventilation space between bags.
Fish meal	High	Bags, Bulk	Keep moisture 6 percent to 12 percent. Avoid exposure to heat.	Dangerous if over dried or packaged over 100°F (38°C).
Fish Oil	High	Barrels, Drums, Tank Cars	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Impregnated porous or fibrous materials are extremely dangerous. Tendency of various fish oils to heat varies with origin.
Fish Scrap	High	Bulk, Bags	Avoid moisture extremes.	Scrap loaded or stored before cooling is extremely liable to heat.

Name	*Tendency to Spontaneous Heating*	*Usual Shipping Container or Storage Method*	*Precautions Against Spontaneous Heating*	*Remarks*
Foam Rubber in Consumer Products	Moderate	Bulk, Bags	Where possible remove foam rubber pads, etc. from garments to be dried in dryers or over heaters. If garments containing foam rubber parts have been artificially dried, they should be thoroughly cooled before being piled, bundled, or put away. Keep heating pads, hair dryers, other heat sources from contact with foam rubber pillows, etc.	Foam rubber may continue to heat spontaneously after being subjected to forced drying as in home or commercial dryers, and after contact with heating pads and other heat sources. Natural drying does not cause spontaneous heating.
Grain (various kinds)	Very slight	Bulk, Bags	Avoid moisture extremes	Ground grains may heat if wet and warm.
Hay	Moderate	Bulk, Bales	Keep dry and cool	Wet or improperly cured hay is almost certain to heat in hot weather. Baled hay seldom heats dangerously.
Hides	Very slight	Bales	Keep dry and cool.	Bacteria in untreated hides may initiate heating.
Iron Pyrites	Moderate	Bulk	Avoid large piles. Keep dry and cool.	Moisture accelerates oxidation of finely divided pyrites.
Istle	Very slight	Bulk, Bales	Keep cool and dry.	Heating possible in wet materials. Unlikely under ordinary conditions. Partially burned or charred fiber is dangerous.
Jute	Very slight	Bulk	Keep cool and dry.	Avoid storing or loading in hot wet piles. Partially burned or charred material is dangerous.
Lamp Black	Very slight	Wooden Cases	Keep cool and dry.	Fires most likely to result from sparks or included embers, etc., rather than spontaneous heating.
Lanolin	Negligible	Glass, Cans, Metal Drums, Barrels	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Heating possible on contaminated fibrous matter.
Lard Oil	Slight	Wooden Barrels	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Dangerous on fibrous combustible substances.
Lime, unslaked (Calcium Oxide, Pebble Lime, Quicklime)	Moderate	Paper Bags, Wooden Barrels, Bulk	Keep dry. Avoid hot loading.	Wetted lime may heat sufficiently to ignite wood containers, etc.
Linseed	Very slight	Bulk	Keep cool and dry.	Tendency to heat dependent on moisture and oil content.
Linseed Oil	High	Tank, Cars, Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Rags or fabrics impregnated with this oil are extremely dangerous. Avoid piles, etc. Store in closed containers, preferably metal.
Manure	Moderate	Bulk	Avoid extremes of low or high moisture contents. Ventilate the piles.	Avoid storing or loading uncooled manures.
Menhaden Oil	Moderate to high	Barrels, Drums, Tank Cars	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Dangerous on fibrous product.
Metal Powders*	Moderate	Drums, etc.	Keep in closed containers.	Moisture accelerates oxidation of most metal powders.

Name	Tendency to Spontaneous Heating	Usual Shipping Container or Storage Method	Precautions Against Spontaneous Heating	Remarks
Metal Turnings*	Practically none	Bulk	Not likely to heat spontaneously.	Avoid exposure to sparks.
Mineral Wool	None	Pasteboard Boxes, Paper Bags	Noncombustible. If loaded hot may ignite containers and other combustible surroundings.	This material is mentioned in this table only because of general impression that it heats spontaneously.
Mustard Oil, Black	Low	Barrels	Avoid contact of leakage with rags, cotton or other fibrous combustible materials.	Avoid contamination of fibrous combustible materials.
Oiled Clothing	High	Fiber Boxes	Dry thoroughly before packaging.	Dangerous if we material is stored in piles without ventilation.
Oiled Fabrics	High	Rolls	Keep ventilated. Dry thoroughly before packing.	Improperly dried fabrics extremely dangerous. Tight rolls are comparatively safe.
Oiled Rags	High	Bales	Avoid storing in bulk in open.	Dangerous if we with drying oil.
Oiled Silk	High	Fiber Boxes, Rolls	Supply sufficient ventilation.	Improperly dried material is dangerous in form of piece goods. Rolls relatively safe.
Oleic Acid	Very slight	Glass Bottles, Wooden Barrels	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated.
Oleo Oil	Very slight	Wooden Barrels	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	May heat on impregnated fibrous combustible matter.
Olive Oil	Moderate to Low	Tank Cars, Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Paint containing drying oil	Moderate	Drums, Cans, Glass	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Fabrics, rags, etc. impregnated with paints that contain drying oils and driers are extremely dangerous. Store in closed containers, preferably metal.
Paint Scrapings	Moderate	Barrels, Drums	Avoid large unventilated piles.	Tendency to heat depends on state of dryness of the scrapings.
Palm Oil	Low	Wooden Barrels	Avoid contact of leakage form containers with rags, cotton or other fibrous combustible materials	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Peanut Oil	Low	Wooden Barrels, Tin Cans	Avoid contact of leakage form containers with rags, cotton or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Peanuts, "Red Skin"	High	Paper Bags, Cans, Fiber Board Boxes Burlap Bags	Avoid badly ventilate storage.	This is the part of peanut between outer shell and peanut itself. Provide well ventilated storage.
Peanuts, shelled	Very slight or Negligible	Paper Bags, Cans, Fiber Board Boxes, Burlap Bags	Keep cool and dry.	Avoid contamination of rags, etc., with oil.
Perilla Oil	Moderate to High	Tin Cans, Barrels	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.

Name	Tendency to Spontaneous Heating	Usual Shipping Container or Storage Method	Precautions Against Spontaneous Heating	Remarks
Pine Oil	Moderate	Glass, Drums	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Powdered Eggs	Very slight	Wooden Barrels	Avoid conditions that promote bacterial growth. Inhibit against decay. Keep cool.	Possible heating of decaying powder in storage.
Powdered Milk	Very slight	Wooden and Fiber Boxes, Metal Cans	Avoid conditions that promote bacterial growth. Inhibit against decay. Keep cool.	Possible heating by decay or fermentation.
Rags	Variable	Bales	Avoid contamination with drying oils. Avoid charring. Keep cool and dry.	Tendency depends on previous use of rags. Partially burned or charred rags are dangerous.
Red Oil	Moderate	Glass Bottles, Wooden Barrels	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Impregnated porous or fibrous materials are extremely dangerous. Tendency varies with origin of oil.
Roofing Felts and Papers	Moderate	Rolls, Bales, Crates	Avoid over-drying the material. Supply ventilation.	Felts, etc., should have controlled moisture content. Packaging or rolling uncooled felts is dangerous.
Sawdust	Possible	Bulk	Avoid contact with drying oils. Avoid hot, humid storage.	Partially burned or charred sawdust may be dangerous.
Scrap Film (Nitrate)	Very slight	Drums and Lined Boxes	Film must be properly stabilized against decomposition.	Nitrocellulose film ignites at low temperature. External ignition more likely than spontaneous heating. Avoid exposure to sparks, etc.
Scrap Leather	Very slight	Bales, Bulk	Avoid contamination with drying oils.	Oil-treated leather scraps may heat.
Scrap Rubber or Buffings	Moderate	Bulk, Drums	Buffings of high rubber content should be shipped and stored in tight containers.	Sheets; slabs, etc. are comparatively safe unless loaded or stored before cooling thoroughly.
Sisal	Very slight	Bulk, Bales	Keep cool and dry.	Partially burned or charred material is particularly liable to ignite spontaneously.
Soybean Oil	Moderate	Tin Cans, Barrels, Tank Cars	Avoid contact with rags, cotton, or fibrous materials.	Impregnated fibrous materials may heat unless well ventilated.
Sperm Oil -See Whale Oil				
Tankage	Variable	Bulk	Avoid extremes of moisture contents. Avoid loading or storing while hot.	Very dry or moist tankages often heat. Tendency more pronounced if loaded or stored before cooling.
Tung Nut Meals	High	Paper Bags, Bulk	Material must be very carefully processed and cooled thoroughly before storage.	These meals contain residual oil which has high tendency to heat. Material also susceptible to heating if over-dried.
Tung Oil	Moderate	Tin Cans, Barrels, Tank Cars	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Turpentine	Low	Tin, Glass, Barrels	Avoid contact of leakage from containers with rags, cotton, or other fibrous combustible materials.	Has some tendency to heat but less so than the drying oils. Chemically active with chlorine compounds and may cause fire.
Varnished Fabrics	High	Boxes	Process carefully. Keep cool and ventilated.	Thoroughly dried varnished fabrics are comparatively safe.

Name	*Tendency to Spontaneous Heating*	*Usual Shipping Container or Storage Method*	*Precautions Against Spontaneous Heating*	*Remarks*
Wallboard	Slight	Wrapped Bundles, Pasteboard Boxes	Maintain safe moisture content. Cool thoroughly before storage.	This material is entirely safe from spontaneous heating if properly processed.
Waste Paper	Moderate	Bales	Keep dry and ventilated.	Wet paper occasionally heats in storage in warm locations.
Whale Oil	Moderate	Barrels and Tank Cars	Avoid contact of leakage from containers with rags, cotton or other fibrous combustible materials.	Impregnated fibrous materials may heat unless ventilated. Tendency varies with origin of oil.
Wool Wastes	Moderate	Bulk, Bales, Etc.	Keep cool and ventilated or store in closed containers. Avoid high moisture.	Most wool wastes contain oil, etc. from the weaving and spinning and are liable to heat in storage. Wet wool wastes are very liable to spontaneous heating and possible ignition.

* Refers to iron, steel, brass, aluminum, and other common metals, for information on magnesium, sodium, zirconium, etc.

[1]Reprinted with permission from Fire Protection Handbook, 18th edition, Copyright ©1997, National Fire protection Association, Quincy, MA 02269.

The ignition source for a recent large loss was directly attributed to the spontaneous ignition of used rags. The plant had recently switched from a chlorofluorocarbon (CFC) based solvent to a terpene based solvent. The terpene solvent resolved several environmental concerns, however, it also introduced a combustible liquid into a process that previously had none. Used clean-up rags containing terpene solvent were discarded into open top plastic trash barrels where the fire started.

Sources of terpenes are turpentine and other basic oils. Terpene solvents are used as a CFC solvent replacement because they are considered environmentally safe (used for circuit board cleaning). The material safety data sheet for the solvent involved indicated the liquid could polymerize. Chemically, terpenes can have unsaturated bonds which would suggest spontaneous heating tendencies (confirmed by the example loss). Proper disposal (normally closed metal containers) and prompt removal (empty drums at end of shift) of the terpene soaked rags would have eliminated the ignition source and prevented this loss.

The potential for spontaneous heating needs to be considered as a possible ignition source in many occupancies. Recognition of a material that may spontaneously heat, allows the initiation of preventative measures designed to eliminate or control the potential ignition source. Changes in manufacturing materials to comply with new codes and laws must be fully reviewed to assure a clear understanding of any new hazards that are introduced by the changes.

Spontaneous ignition can also take place by other exothermic chemical action, sometimes sudden and violent if highly reactive materials are mixed. Examples are water and sodium, strong oxidizing materials, and organic matter. NFPA 491M, *Manual of Hazardous Chemical Reactions*, gives many specific examples.

5.0 INDICATORS OF SLOW OR FAST—BURNING FIRES

Uniform overhead damage usually indicates a slow and smoldering fire, whereas extensive damage in one place on the ceiling indicates an intense, rapid buildup beginning below this spot. A wide angle "V" pattern indicates a slow-burning fire. A narrow angle "V" indicates a fast-burning fire.

In glass, large cracks and a heavy smoke film generally indicate slow burning, while irregularly shaped cracks and slight smoke film generally indicate rapid burning. A fast, intense fire will cause heavy alligatoring and shiny, smooth blisters on exposed wood surfaces, while a long, low heat source will produce flat alligatoring. In a cross-section of a piece of wood found near the point of origin, a distinct line between charred and uncharred portions of the wood indicates a fast, intense fire. A gradation in charring and an overall baked appearance usually indicate a long, slow fire.

6.0 EFFECTS OF FIRE ON STEEL

Steel has three characteristics that are of concern under fire conditions:

1. Steel expands substantially when heated.
2. Steel loses strength substantially when heated to temperatures in excess of 900° to 1000°F (480° to 540°C).
3. Steel transmits heat readily.

6.1 Thermal Expansion

If the ends of a steel member are free to move, the increase in length is approximately 0.065 percent for each 100°F rise in temperature (0.125 percent for each 100°C rise in temperature). For example, a 100 ft (30 m) long steel beam heated uniformly to 1000°F (556°C) above ambient will increase in length by almost 8 in. (200 mm). If the ends are fixed, the applied stress will change by about 19,000 psi for each 100°F temperature change (240 MPa [2400 bars] for each 100°C). Uniform heating of long horizontal beams can push over masonry walls or cause shear failure in connections for structural steel members.

Analysis of fire-induced stresses in horizontal cylindrical tanks containing liquefied gas indicates that failure of such tanks under fire conditions is not due to overpressurization nor to weakening of the unwetted shell, but to stresses produced by the axial expansion of the unwetted portion of the shell. As the unwetted portion is heated, it tends to expand, while the immediately adjacent wetted portion of the shell remains cool and restrains the expanding portion. As a result, tensile stress in excess of the ultimate strength of the metal is produced just below the liquid level. The metal starts to rip circumferentially at that point. The tank separates into (usually two) sections which rocket parallel to the axis of the tank.

6.2 Loss of Strength

The strength of mild steel actually increases up to about 600°F (315°C). Beyond that temperature, a decrease in strength occurs until about 1100°F (600°C) when the strength of steel is reduced to a point where it is not sufficient to carry the dead load, and the steel member fails.

Loss of strength is often the result of localized heating due to shielding or obstruction of the water spray from a few sprinklers or due to missing sprinklers. Bar joists and steel trusses are particularly subject to failure due to rapid overheating of thin steel members. The consequences in the case of bar joists may not be serious because large supporting beams that are protected can maintain the overall structural integrity of the building. However, localized overheating of a small section of a large steel truss system can cause major building collapse.

6.3 Thermal Conductivity

Heat can be transmitted through steel to combustible material that is otherwise unexposed to fire, such as steel deck roof insulation and contents of tanks and bins.

6.4 Evaluating Structural Damage

Mild structural steel building members often show no change in physical properties as a result of fire exposure. Many instances have been reported where straightening of distorted structural steel members has been both feasible and economical. Connections between members should be checked for cracks around holes.

Steel which has been exposed to temperatures of 1600°F (870°C) or higher may have a roughened appearance due to excessive scaling and grain coarsening. The steel will usually have a dark gray color, although other colors may be present. Steel so modified is commonly called "burnt" steel. Its suitability for further use is a matter for careful evaluation and judgment.

Steel with a higher carbon content than mild structural steel often has special characteristics determined by heat treating. Fire exposure may significantly change its physical properties and affect its suitability for continued use.

7.0 EFFECTS OF FIRE ON CONCRETE AND MASONRY

Fire alone seldom causes failure of concrete or masonry structural components. Failure is more often due to loss of support or stresses indirectly resulting from the fire. For example:

Masonry walls can be pushed over by expanding concrete or steel members, toppling or expanding storage, or explosion pressures.

Exposed steel-supporting trusses, beams, or columns can fail if not protected by water spray or insulation.

Floors can be overloaded by water-soaked storage.

Spalling can occur due either to expansion of moisture or to thermal expansion of the outer surface in concrete under compression as in columns, walls, or prestressed structural members.

7.1 Evaluating Structural Damage

Damage to concrete is usually superficial in fires with automatic sprinkler protection or in fires lasting less than two hours without sprinklers. If exposure is more severe, a careful study of structural damage is needed.

A waiting period of several weeks will allow damage to concrete to be more discernible from cracking, layering, calcination, or discoloration. The natural gray color changes to pink or brown indicating exposure to temperatures in excess of 450°F (232°C). Unsound concrete will be more or less soft and friable when chipped with a pick or hammer. Core samples of concrete and samples of reinforcing steel for load tests give more accurate quantitative measurements of structural strength. Such tests and examination should be performed under the supervision of a registered structural engineer.

Loss of tension in prestressed concrete-reinforcing tendons should be investigated where these members have been heated above 300°F (150°C). Ordinary reinforcing steel should be restored to its depth of cover where spalling has occurred to preserve its protection against future fire exposure and corrosion.

8.0 EFFECTS OF FIRE ON WOOD

Although wood is combustible, it has some positive properties from a fire exposure standpoint. For example, it does not expand significantly when heated, it does not lose strength except as it is burned away, and it is much less conductive than steel or concrete.

Thin members, such as boards and joists, burn through or lose strength much more rapidly than planks or plain or laminated timbers. The average rate of penetration of char when flame is impinged upon a wood member is about 1½ in. (40 mm) per hour. This is often useful in tracing the origin of a fire in an area of wood construction or occupancy.

Fire tends to sweep upward until its progress in this direction is blocked by some obstacle. If no holes, cracks, or outlets are present, the flames mushroom out horizontally until they bend around the obstruction and continue upward. Fire does not spread nearly so rapidly in a horizontal direction unless there are favorable ventilation conditions or some fast-burning material present. Fire should not spread downward significantly except in the case of falling, burning material. This also may be useful in tracing the origin of a fire.

Charring of the top surface of a wood floor is usually not evident because flames tend to rise away from the surface, and water from fire fighting readily protects the surface. However, localized charring is often evident. This can indicate the presence of either a combustible surface just above the floor such as a skid radiating heat downward or a thin ignitable liquid layer burning on the floor with some soaking-in to increase the volatility of the wood. It can also indicate a fire near the floor where water cannot penetrate to the floor because of shielding above or absorption by material above such as tissue or plastic foam.

8.1 Evaluating Structural Damage

Except for the volume of wood lost to charring, the strength of a wood structural member is affected very little by fire exposure. After the charred volume has been deducted, the remaining strength can be determined through structural analysis. However, metal-connecting members such as bolts and screws may lose strength or lose their connecting ability due to the burning away of wood.

9.0 EFFECTS OF FIRE ON SPRINKLER SYSTEM

The effect of the fire on the automatic sprinkler system can furnish useful information. This involves two factors: the number of sprinklers that operate, and the damage done to the sprinkler system by the fire.

The operation of an unusually high number of sprinklers can be due to a variety of causes:

1. A water supply too weak for the hazard.

2. The water supply to the sprinklers shut off, either at the start of the fire or during the fire. This may be due to:

   a. a closed valve,

   b. broken pipe,

   c. obstructed pipe,

   d. a dry pipe or deluge valve that failed to open or which was delayed,

   e. impairment of a water supply.

3. Shielded sprinklers

4. Fire that spread ahead of the sprinkler operation due to:

   a. dust, oil, or lint deposits, usually near the ceiling;

   b. fast-burning construction such as plastic foam, usually at the ceiling;

   c. an explosion or "puff" of vapor or dust;

   d. sprinklers located too far below the ceiling.

Damage to sprinklers, piping, or valves indicates that the equipment damaged did not receive water at some time during the fire. The extent of the damage should correspond to the extent of the impairment. A few damaged sprinklers may mean a plugged branch line. A damaged dry-pipe valve may mean an entire system was shut off and drained.

10.0 BASIC DEFINITIONS AND PRINCIPLES—EXPLOSIONS

10.1 Explosion

An explosion is a rapid transformation of potential physical or chemical energy into mechanical energy and involves the violent expansion of gases. This gas expansion creates a blast wave, with an overpressure and duration depending on the type of explosion. The two parameters of the blast wave that are important for evaluation of its damage potential are the maximum overpressure (P_{max}) and the impulse (I) of the positive phase of the pressure-time curve. Figure 1 illustrates the different pressure time profiles of deflagration and detonation waves.

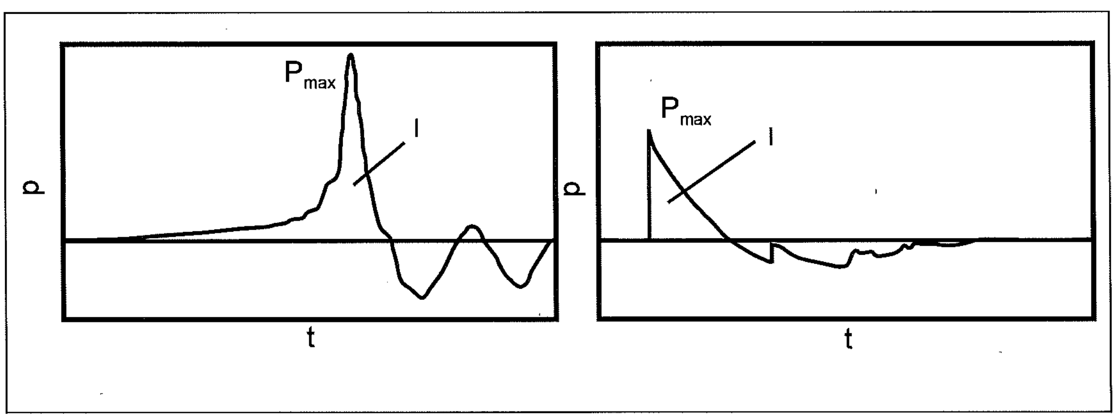


Fig. 1. Examples of pressure & impulse profiles from deflagration (left) and detonation

10.2 Physical Explosion

A physical explosion originates from purely physical phenomena, such as rupture of a boiler or pressurized container, or from interaction between water and molten metal or black liquor smelt.

Flash vaporization, the rapid vaporization of a superheated liquid when the pressure has been suddenly released, is an example of a physical explosion. This phenomenon often occurs when water is trapped under hot oil.

10.3 Chemical Explosion

A chemical explosion originates from a chemical reaction such as a flammable vapor air explosion, a dust explosion, or detonation of an explosive or blasting agent.

10.4 Thermal Explosion

A thermal explosion is the result of an exothermic reaction occurring under conditions of confinement with inadequate cooling. As the temperature rises, the reaction rate and heat generation accelerate until the container falls due to overpressure. See Data Sheet 7-49, *Emergency Venting of Vessels*.

10.5 BLEVE

A BLEVE (boiling liquid expanding vapor explosion) results from the rupture of a vessel containing a liquid substantially above its atmospheric boiling point. It may be a physical explosion or a thermal explosion. Energy is produced by the expanding vapor and boiling liquid. If the vapor is flammable and is ignited, a fireball ensues. Since the vapor is not premixed with air, if ignition is immediate, the main effect of the combustion is fire and radiant heat rather than explosive force (overpressure effects). A BLEVE can occur with a nonflammable liquid as with a rupturing hot water heater.

10.6 Deflagration

A deflagration is an exothermic reaction that propagates from the burning gases to the unreacted material by conduction, convection, and radiation. The combustion zone progresses at a rate that is less than the velocity of sound in the unreacted material. The unreacted material may be compressed by the force exerted by the deflagration, and the reaction rate may increase as a result. If this continues for a sustained time, as in a pipeline, the reaction rate may increase to sonic velocity, and a detonation may result.

10.7 Detonation

A detonation is an exothermic reaction propagating at greater than sonic velocity in the unreacted material. A shock wave is established and maintains the reaction. Detonations usually take place in solid or liquid materials such as explosives or blasting agents, and on rare occasions, explosions in gases can reach detonation velocity if confined for considerable distances as in pipelines.

10.8 The Mechanism of Explosion

Since an explosion is the rapid transformation of potential physical or chemical energy into mechanical energy, a common sequence of events takes place in all explosion processes.

1. Preceding the explosion, there is a buildup period during which the potential physical or chemical energy accumulates in a manner in which it may be suddenly transformed.

2. At the instant of the explosion, a triggering agent is introduced into the system which initiates the energy transformation.

3. During the buildup period, the triggering agent must be absent.

10.9 The Buildup Period

The buildup period may be anything from a fraction of a second to hours or days. During this time, "the stage is being set" for the explosion. Examples are:

1. A cloud of flammable gas or vapor mixes with air, leading to a gas or vapor/air explosion.
2. A cloud of dust mixes with air, leading to a dust explosion.
3. Pressure builds up in a tank, leading to a vessel rupture.
4. Molten metal or black liquor smelt accumulates, leading to a molten substance/water explosion.
5. A charge of explosive material is placed, leading to a blasting explosion.
6. A chemical reaction in a vessel "runs away", leading to a thermal explosion.

10.10 The Triggering Agent

The triggering agent may be introduced into the system, or the buildup period may spread or travel to encompass the triggering agent.

1. An ignition source, such as a spark or flame, may be introduced into an enclosure after a cloud of flammable vapor or gas is mixed with air, or the vapor/air cloud expands or moves to encompass the ignition source.

2. A dust/air cloud contacts a spark or flame sufficient for ignition.

3. The walls of a vessel rupture, transforming the potential physical energy into the expanding mechanical energy of the gas.

4. Water contacts a hot molten material converting the heat energy into expanding vapor.

5. A detonator or other shock-producing device detonates an explosive material.

6. Failure of a vessel wall converts the thermal chemical energy into a BLEVE or vessel-rupture explosion. The thermal explosion process itself may have been initiated by sudden mixing of two chemicals.

10.11 Explosion Prevention

The explosion may be prevented or transformed into a controlled release of energy by preventing the buildup period or the triggering agent, or by insuring that the triggering agent is present during the buildup period:

1. A vapor/air explosion can be prevented by excluding the flammable vapor from the system, by keeping air out of the system, by preventing any chance of ignition, or by insuring that an ignition source is present when air and fuel are first introduced, as at the burner of a furnace.

2. A dust explosion can be averted by preventing the formation of dust/air clouds, by keeping ignition sources away from dust/air clouds, or by (in the case of a pulverized fuel burner) insuring that an ignition source is present when pulverized fuel is dispersed.

3. A vessel rupture explosion can be averted by preventing a pressure buildup beyond safe limits, by insuring that the vessel walls do not fail below the maximum allowable pressure, and by releasing the energy by opening the vessel (through a relief valve or rupture disk) before excessive pressure buildup takes place.

4. A water/molten material explosion can be prevented by excluding molten material, by keeping water from contacting molten material, or by introducing the molten material in very small quantities to absorb the energy gradually, as in the dissolving tank of a black liquor boiler.

5. A blasting explosion may be prevented by keeping explosives out of the area, or by keeping detonating agents away from the explosives.

6. A thermal explosion can be prevented by controlling the exothermic reaction, by adequate cooling or other reaction suppression devices and by the gradual release of energy by venting devices.

11.0 EFFECTS OF EXPLOSIONS

Explosion effects are from the sudden release of mechanical energy in the form of pressure as a blast wave. Buildings can be destroyed or damaged by the pressure as well as the duration of the pressure.

11.1 Detonations

Detonations release a very large amount of energy within a relatively small volume. Extremely high pressures are produced in the immediate vicinity of the detonating material and the explosion occurs too quickly for venting to have any effect. As a result, there is usually shattering or pulverizing of steel or concrete, and a crater may be formed. Detonations can occur in some explosives, highly reactive gases (e.g., hydrogen) or even less-reactive gas-air mixtures in piping systems.

11.1.1 Energetic Materials

Energetic materials, such as TNT, dynamite, rocket propellants, and ammonium nitrate, etc., can accidentally explode during manufacture or storage causing widespread damage. TNT equivalence is an appropriate way to evaluate the effects of energetic material explosions and is discussed in Data Sheet 7-28, *Energetic Materials.*

11.1.2 Blast Waves and Overpressures

Blast waves are a major consequence of all explosions and move outward in a spherical shape like the ripple of a stone dropped in a pool of water. The amplitude (overpressure) and duration are related to the amount of energy released and how quickly it is released. The blast wave energy (overpressure and duration) decays at a rate proportional to the cube root of the distance from the explosion (Hopkinson-Cranz Scaling Law).

The common practice in predicting effects of explosion has been to translate the energy released into TNT equivalent. Most common explosives have TNT equivalents. Other references are available for estimating the TNT equivalence of other phenomena (Lees, Stephens).

Using the scaling law (Equation 1) it is then possible to predict blast effects in terms of overpressure.

$$R_g = Z_g\,(W_e)^{1/3} \qquad \text{(Eq. 1)}$$

Where:
R_g = Radial distance from energy release epicenter (expressed in feet or meters), at some overpressure
Z_g = Scaled ground distance (ft/lb$^{1/3}$ [m/kg$^{1/3}$]) from Table 3a or 3b for a defined overpressure
W_e =TNT equivalent mass, expressed in pound or kilograms

Table 3a. Scaled Ground Distance at Overpressures (English)

Overpressure, P (psig)	*Scaled Ground Distance, Z ft/lbs $^{1/3}$*
15	8
10	9.8
6	13
5	14.5
3	19.5
2	26
1	45

Table 3b. Scaled Ground Distance at Overpressures (Metric)

Overpressure, P (barg)	*Scaled Ground Distance, Z m/kg $^{1/3}$*
1.03	3.2
0.69	3.89
0.41	5.2
0.34	5.75
0.21	7.7
0.14	10.0
0.07	17.9

After calculating the distance to the selected overpressure the overpressure rings can be plotted on a plan view of the site centered on the explosion.

Damage tables based on overpressure are available from a number of sources (Lees, Stephens). There are also effects related to the duration (impulse), but for most property loss evaluations this was generally not considered. More recently, evaluations have been done considering both overpressure and impulse.

11.1.3 Craters

If a detonation takes place near the surface of the ground, a crater may be produced. The size of the crater can vary widely, but an approximation can be made for dry soil by using the formula $D = 1.5\ W^{1/3}$ where D is the crater diameter in feet, and W is the charge weight in pounds of TNT. In metric units, $D = 0.6\ W^{1/3}$ where D is the crater diameter in meters, and W is the charge weight in kilograms of TNT. The depth of the crater is normally about one-quarter of the diameter.

11.2 Deflagrations

Deflagrations release energy more slowly and the combustion occupies a larger volume. The overpressures developed are less than those from a detonation, and venting of the building or vessel can often reduce the damage effects to an acceptable level. Damage is more likely to involve tearing of materials into relatively large pieces. Craters are usually not produced.

11.3 Vapor Cloud Explosions (VCE)

In most deflagrations, the overpressures produced in the explosion are confined to process equipment or a building. In some cases, such as at petrochemical plants or refineries, a large cloud of flammable vapor can be released outdoors into a partially confined and/or congested open process structure. The resulting VCE can produce severe damage over a wide area, sometimes even beyond the plant boundaries. Refer to Data Sheet 7-42, *Guidelines for Evaluating the Effects of Vapor Cloud Explosions using a Flame Acceleration Model,* for details on vapor cloud explosions.

TNT equivalence methods have been used in the past to predict blast effects of vapor cloud explosions but are no longer widely used for hazard evaluations. Energy release effects from explosives, blast wave and impulse, are different from that caused by flammable vapor clouds and pressure vessel ruptures, and using TNT equivalents can overestimate near field effects and underestimate the far field effects.

Flame acceleration models (FAM) for prediction of outdoor gas clouds are more accurate and have been implemented by FM Global for property loss evaluation. Details are covered in Data Sheet 7-42.

11.4 Vessel Ruptures and BLEVES

When a vessel containing a gas under pressure ruptures, the mechanical energy released is proportional to the volume of gas times the pressure, assuming that is the only energy available. If the vessel comes apart completely so that all the energy is released at once, a shock wave may be produced. However, if the pressure buildup is relieved, for example by a manhole cover coming off, the vessel may remain largely intact and the energy is released over a longer period. Damage may be limited to that done by the flying cover or rocketing tank.

If the material in a vessel is noncombustible, the effects of the overpressure will be a blast wave proportional to the mechanical energy released plus fragments from the vessel. If the material in the vessel is corrosive, in addition to blast and fragment effects, widespread damage to process areas from later corrosion might occur. If the material is an ignitable liquid or flammable gas, a number of "add on" events could occur, such as a fire ball with radiant heat effects and subsequent fires.

If the vessel contains liquid well above its atmospheric boiling point, a portion of the liquid instantly vaporizes when the pressure is released. The unvaporized liquid is carried with the expanding vapors and the event is often called a BLEVE (boiling liquid expanding vapor explosion). The liquid doesn't have to be flammable to be considered a BLEVE.

Historically, a number of scenarios have resulted in pressure vessel ruptures in process equipment and mobile storage vessels, including the following:

- Process vessels operating in corrosive conditions
- Process vessels with potential for internal hidden corrosion such as lined, clad, or overlaid construction
- Process vessels with external hidden corrosion, such as under exterior insulation
- Vessels with known metallurgical defects
- Chemical reactors running exothermic reactions with incorrectly sized, plugged, or impaired pressure relief devices
- Vessels with the potential to be connected to high-pressure services (e.g., air, steam, or process lines) where the pressure is significantly greater than the ultimate failure pressure of the vessel (MAWP plus design safety factors)
- Process vessels weakened by exposure to an uncontrolled fire

11.4.1 Pressure Vessel Rupture Failure Pressure

The pressure at which a vessel fails can vary depending on operating conditions, defects, and overpressure scenarios. Pressure vessels typically have an ultimate failure pressure with a safety margin above the design maximum allowable working pressure (MAWP). For ASME code vessels this margin can be 3.5 to 4 times the MAWP, depending on the version or section of the code that applies. European design codes typically have smaller safety margins, such as 2.4 times MAWP for carbon steel without corrosion or fabrication allowances. Determine the pressure at vessel failure based on one of the criteria below:

A. Use the highest normal operating pressure of a vessel
   - in corrosive service or environment.
   - with known metallurgical defects.

B. Use the ultimate failure pressure (MAWP plus design safety factors) of a vessel
   - containing highly reactive systems (exothermic reactors).
   - that can be accidentally exposed to pressure exceeding the ultimate failure pressure.

11.4.2 Pressure Vessel Rupture Energy Release

If energy contained in a pressurized vessel is released by sudden failure of the shell, the effects can be estimated using pressure-volume (bursting pressure vessel) calculation models. There are a number of models to estimate the energy release from a bursting pressure vessel. An isothermal expansion model was previously suggested to tie in with the TNT equivalent method. FM Global has developed proprietary software, BlastCalc, which will be used by FM Global engineers for pressure vessel rupture evaluations. The energy release is based on Brode's constant volume energy addition approach tied in with pressure wave parameters from bursting vessels.

Chapter 7 of the CCPS Guideline book on vapor cloud explosions (see 12.2) provides some guidance on calculation methods as well as worked examples for evaluating blast effects produced by these events.

11.4.3 Loss Examples

11.4.3.1 Kaiser Aluminum and Chemical Corporation, Gramercy, Louisiana, USA

On July 5, 1999 an explosion occurred at an alumina refinery. The incident occurred in a high-pressure alumina ore processing system that had been weakened by corrosion and reportedly had impaired pressure relief systems. The accident caused the rupture of all five digesters in the process. Four of the five digesters had volumes of 68,000 gal (260 m^3), and one had a capacity of 180,000 gal (690 m^3). The design temperature was 600°F (315°C) and the MAWP was 600 psig (41 barg). Records show the failure pressure of the vessels was between 600 and 633 psig (41 and 44 barg).The ruptures essentially destroyed the processing plant. There were no ensuing fires. The gross loss estimate was over US$500 million. This incident was investigated by the US Mine Safety and Health Administration (MSHA) and a report was issued.

12.0 REFERENCES

12.1 FM Global

Data Sheet 7-12, *Mining and Ore Processing Facilities*
Data Sheet 7-28, *Energetic Materials*
Data Sheet 7-42, *Guidelines for Evaluating the Effects of Vapor Cloud Explosions using a Flame Acceleration Model*
Data Sheet 7-55, *Liquefied Petroleum Gas (LPG) in Stationary Installations*
Data Sheet 7-64, *Aluminum Industry*
Data Sheet 7-89, *Ammonium Nitrate and Mixed Fertilizers containing Ammonium Nitrate*

12.2 Others

Brode, H.L. "Blast Wave from a Spherical Charge." *Physics of Fluids* 2(2): 217-219.

Center for Chemical Process Safety (CCPS). *Guidelines for Vapor Cloud Explosion, Pressure Vessel Burst, BLEVE and Flash Fire Hazards.* Second Edition. 2010.

Fig. 2. Damage after the explosion.

Lees, F.P. *Loss Prevention in the Process Industries.* 2nd Edition. Elsevier, 1996.

Stephens, M.M. *Minimizing Damage to Refineries from Nuclear Attack, Natural, and Other Disasters.* US Dept. of the Interior, Office of Oil and Gas, Prepared for the Department of the Army, Series Report No. AD-773-048. February 1970.

US Department of Labor, Mine Safety and Health Administration (MSHA). *Nonfatal Exploding Vessels Accident, Gramercy Works, Kaiser Aluminum and Chemical Corporation.* ID No. 16-00352. July 5, 1999.

APPENDIX A GLOSSARY OF TERMS

Ignitable Liquid: Any liquid or liquid mixture that is capable of fueling a fire, including flammable liquids, combustible liquids, inflammable liquids, or any other reference to a liquid that will burn. An ignitable liquid must have a fire point.

Ultimate failure pressure: Internal pressure at which a vessel will fail catastrophically. For ASME code vessels this pressure can be 3.5 to 4 times the MAWP, depending on the version or section of the code that applies. European design codes typically have smaller safety margins, such as 2.4 times MAWP for carbon steel without corrosion or fabrication allowances.

MAWP: maximum allowable working pressure is the maximum pressure to which a vessel may be subjected during operation. It is code limited and determined by either the manufacturer or by analysis. The value is usually stamped on the vessel nameplate.

APPENDIX B DOCUMENT REVISION HISTORY

April 2013. Minor editorial changes and additional guidance for using TNT equivalence methods for estimating the effects of explosions (overpressure) involving energetic materials.

October 2012. References to the use of TNT equivalence to evaluate the effects of vapor cloud explosions were replaced with the use of flame acceleration modeling and pressure-impulse effects. Additional guidance was provided for estimating the effects of pressure vessel rupture using pressure-impulse methods to evaluate the explosion effects.

January 2012. Terminology related to ignitable liquids has been revised to provide increased clarity and consistency with regard to FM Global's loss prevention recommendations for ignitable liquid hazards.

April 1994. Revised to remove guidance on vapor cloud explosions to new 7-0S.

July 1981. First publication.

FM Global Property Loss Prevention Data Sheets 7-89 (October 2013)
Ammonium Nitrate and Mixed Fertilizers Containing Ammonium Nitrate

AMMONIUM NITRATE AND MIXED FERTILIZERS CONTAINING AMMONIUM NITRATE

Table of Contents

Page

List of Figures

1.0 SCOPE

This data sheet covers all types of ammonium nitrate (AN) storage except blasting agents and commercial explosives, which are covered by Data Sheet 7-28, *Energetic Materials*.

It also addresses the explosion hazard of *liquid* ammonium nitrate (LAN) solutions produced in fertilizer grade ammonium nitrate plants. It applies only to facilities with liquid AN solutions in concentrations of 83% or greater. It also applies only to process equipment producing AN solutions, such as neutralization reactors and attached process surge tanks. It does not apply to standalone bulk storage tanks of AN solutions on chemical, fertilizer or distribution sites that are not directly part of the production process.

It provides guidance for minimizing the potential for explosion by effective use of Process Safety Management (PSM) Systems which include ensuring adequate process design, process control, process hazard knowledge, operating procedures, and management of change.

1.1 Changes

October 2013. Editorial corrections, the correction of the NFPA code references on ammonium nitrate and updating the information on hazard testing of fertilizer blends of ammonium nitrate with other components (fuse decomposition).

2.0 LOSS PREVENTION RECOMMENDATIONS

Since a wide variety of processes for producing AN exist worldwide and process conditions (such as acid concentration and solution temperatures within these various processes) vary widely, specific guidance on recommended parameter set points cannot be provided. Further, loss history demonstrates that AN solutions are very stable from an explosivity standpoint and that several adverse conditions in combination must occur before the solution or process enters an unsafe condition sensitive to detonation. Usually this occurs over time. Each facility needs to fully understand the range of acceptable safe operating conditions for that facility, establish safe boundaries of operation, and have controls and management systems in place to safely shut down the process when these boundaries are exceeded.

For this reason, the following recommendations are presented as performance-based guidelines rather than specification-based standards.

2.1 Ammonium Nitrate Manufacturing

2.1.1 Introduction

2.1.1.1 Facilities producing LAN should have a Process Safety Management (PSM) System in place to ensure that the following (or equivalent) elements of process safety are integrated into plant operations:

a) Accountability

b) Process Knowledge and Documentation (Process Hazard Analysis)

c) Capital Project Review and Design Procedures

Note: These 12 elements are based on the Center for Chemical Process Safety (CCPS) "Plant Guidelines for Technical Management of Chemical Process Safety." Other PSM guidelines of equal value exist and can be substituted. See Data Sheet 7-43 for additional guidance on PSM.

d) Process Risk Management e) Management of Change

f) Process and Equipment (Mechanical) Integrity

g) Incident Investigation

h) Training and Performance

i) Human Factors

j) Standards, Codes and Laws

k) Audits and Corrective Actions

l) Enhancement of Process Safety Knowledge

2.1.2 Construction and Location

2.1.2.1 Locate manufacturing equipment in the open or in steel frame buildings of damage limiting construction.

2.1.3 Occupancy

2.1.3.1 The potential for *sensitization* of process AN solutions should be minimized by fully understanding, through process hazard analysis, and controlling the following process or contaminant conditions:

a) high acid concentration; typical operating range pH is 3 to 5

b) low solution density

c) bubble formation (solution aeration)

d) organic contaminants

e) chloride contaminants; typically a few ppm

f) metal contaminants; typically 10's of ppm

g) high temperature; typical operating range is 260-290°F (127-143°C)

h) confinement

i) lack of or poor circulation of solution

j) formation of nitrous oxides

2.1.3.2. The potential for *concentration* of the solution above normal process conditions should be minimized by fully understanding and controlling the following conditions:

a) high temperature sources, such as steam

b) high acid concentration

c) confinement without circulation during idle periods

2.1.3.3 Physical process controls and emergency actions as needed should be provided to alarm or safely shutdown the process to control conditions that could sensitize or concentrate an AN solution. At a minimum:

a) Continuous temperature and acid concentration monitoring should be provided for AN neutralization reactors and attached process equipment. Set point boundaries should be determined based on plant design. These controls should be monitored at constantly attended control stations.

b) Routine contaminant testing, such as for chlorides in water systems, should be done. Potential sources of contaminants should be identified and eliminated through process hazard review.

c) The ability to emergency dump the contents of a neutralization reactor system to a safe area or add water to the circulating system, when safe operating boundaries are exceeded, should be studied and provided if economical and feasible.

d) All changes to the process should be subject to a Management of Change procedure.

2.1.3.4. Operators should be fully aware of the hazards of AN solutions and the conditions that could cause the solutions to become sensitized or concentrated such as allowing long idle conditions which allow liquid to stand confined without circulation or adding steam heat to prevent freezing. Operators should also have full authority and willingness to stop a reaction and emergency dump or water flood the contents of a reactor system when safe boundary conditions are exceeded.

2.1.3.5 Design the entire process equipment to minimize the holdup of ammonium nitrate solids or concentrated solutions, particularly where temperatures are elevated. Design piping to minimize the probability of valving off sections of high temperature or high concentration ammonium nitrate.

2.1.4 Protection

2.1.4.1 Provide automatic sprinkler protection for all combustible construction and all combustible occupancy in both the manufacturing and storage areas.

2.2 Storage of Ammonium Nitrate or Blends Containing More Than 60% Ammonium Nitrate or 40% or More of Ammonium Nitrate Mixed with Ammonium Sulfate

2.2.1 Construction and Location

2.2.1.1 Buildings for the storage of bulk or bagged ammonium nitrate or blended fertilizers high in ammonium nitrate should be of noncombustible construction.

2.2.1.2 Storage of bulk or bagged ammonium nitrate or blends high in ammonium nitrate should be located away from important buildings or structures, in accordance with the following guidelines:

a) Piles of less than 50 T (45 tonnes) AN — minimal detonation hazard so no specific separation except to prevent fire propagation from adjoining areas.

b) Piles exceeding 50 T (45 tonnes) AN – detonation potential assumed. Provide separation assuming detonation of 10% of the pile up to a maximum of 500 T (450 tonnes) of AN involved.

c) An explosion efficiency factor of 33% for the detonation of AN compared to TNT.

d) The explosion overpressure rings and damage effects should be calculated using the TNT equivalency method discussed in Data Sheet 7-0, Section 11.0.

e) Sympathetic detonation of nearby piles of uncontaminated AN is not expected.

Examples:

Spacing for a 40 T (36 tonnes) pile of AN would be based on preventing fire propagation from adjoining areas.

Spacing for a 200 T (181 tonnes) pile of AN would be based on the detonation of 20 T (18 tonnes) AN with a TNT equivalent energy of 6.6 T (6 tonnes).

Spacing for a 750 T (680 tonnes) pile of AN would be based on the detonation of 50 T (45 tonnes) AN with a TNT equivalent energy of 16.5 T (15 tonnes).

2.2.2 Occupancy

2.2.2.1 Never loosen caked storage by blasting. Never store ammonium nitrate with explosives, blasting agents, booster charges, or detonating materials. Other materials that may require blasting to loosen should not be stored in the same building with ammonium nitrate.

2.2.2.2 The storage area should be dedicated to ammonium nitrate storage to minimize the possibility of contamination. Particularly avoid contamination with materials such as ignitable liquids, finely divided metals, greases, sulfur, hydrocarbons, acids, fibers, and most finely divided organic materials.

2.2.2.3 Avoid material handling practices and maintenance of material handling equipment which would result in contamination of the ammonium nitrate with organic materials. Remove and dispose of contaminated material immediately.

2.2.2.4 Locate storage in noncombustible construction on floors with no open drains, traps, tunnels, pits or pockets where molten ammonium nitrate can collect and be confined in the event of fire.

2.2.2.5 For bagged storage of fertilizer grade AN (palletized or solid piled) the following criteria apply:

a) Limit the height of bagged storage to 20 ft (6.1 m)

b) To limit spread of fire through pallet channels and to facilitate fire fighting, arrange palletized storage so that any point on a line through the pallet channels, running at right angles to the aisles, is no further than 10 ft (3 m) from the aisles. Overall distance along the channels should not exceed 20 ft (6 m).

c) Limit the quantity of bagged storage in a single building to 5000 tons (4500 tonnes) maximum, arranged in 1000 ton (900 tonnes) piles separated by 10 ft (3 m) aisles.

d) Arrange unpalletized storage so that no point within a pile is more than 10 ft (3 m) from an aisle.

e) The length of pile for both palletized and solid-pile bagged storages is limited by the other dimensions of the pile and the 1000 ton (900 tonnes) limitation. Pile sizes for bulk storage are not limited.

f) Bagged storage should be kept at least 30 in. (0.75 m) from any walls of the storage building.

2.2.3 Protection

2.2.3.1 If protection is provided over conveyor belts and any other combustibles located in the storage building, automatic sprinkler protection need not be provided over bulk storage. (Protect conveyers in accordance with Data Sheet 7-11, *Belt Conveyers.*)

2.2.3.2 Provide automatic sprinkler protection for bagged storage of ammonium nitrate regardless of construction. Install automatic sprinklers in accordance with Data Sheet 8-9, *Storage of Class 1,2,3,4 and Plastic Commodities.* Protection should be as required for a Class 1 commodity, considering ammonium nitrate to be a noncombustible material, except hose stream demand should be a minimum of 500 gpm (1890 l/min).

2.2.3.3 Provide small hose protection for first-aid fire fighting.

2.2.4 Equipment and Processes

2.2.4.1 Arrange the process to deliver ammonium nitrate to the storage area at temperatures below 130°F (55°C).

2.2.5 Contingency Planning

2.2.5.1 Alert emergency organizations and public fire departments to the hazards of ammonium nitrate storage. In the event of fire, use large volumes of water as quickly as possible. Provide and use self-contained breathing apparatus.

2.2.6 Ignition Source Control

2.2.6.1 Control or eliminate ignition sources within the storage building. Keep all storage away from steam lines, radiators, light bulbs or other heat sources.

2.3 Storage of Mixed Fertilizers Containing Lower Concentrations of Ammonium Nitrate

2.3.1 Occupancy

2.3.1.1 Fertilizers containing more than 15% ammonium nitrate (5-X-X if all N_2 is derived from ammonium nitrate) should be tested for fuse-type decomposition. If the mix is susceptible to fuse-type decomposition, the formula should be changed to a thermally stable mix. If this cannot be done, the storage should be arranged and protected as recommended above for high-concentration ammonium nitrate.

2.3.1.2 Mixes which do not prove to be subject to fuse-type decomposition or which contain less than 15% ammonium nitrate should be stored and handled as any inert material.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Processes

3.1.1 Ammonium Nitrate

Ammonium nitrate (NH_4NO_3) is a white crystalline or granular solid which readily absorbs moisture and is highly soluble in water.

The two major uses of ammonium nitrate are in fertilizers, either by itself or as a major ingredient, and as an ingredient in the manufacture of blasting agents. Mixed 50% with TNT, it forms Amatol, which is used in shells and bombs. It is also used in the commercial production of nitrous oxide.

Fertilizer grade ammonia nitrate production facilities are usually on the site of a larger fertilizer complex which manufactures ammonia and other fertilizers such as solid urea and urea-ammonia nitrate solution mixtures. In the past, most plants produced solid (prilled) AN. However, in recent years liquid products have become more prevalent.

AN is produced by reacting 55-56% nitric acid with ammonia in a continuous neutralization process. The nitric acid is usually produced on site from ammonia and the ammonia is produced by steam reforming of natural gas, also on site. Occasionally ammonia and nitric acid will be purchased and stored for production at a stand alone AN plant.

The reaction between ammonia and nitric acid produces 83% AN in water solution. Process conditions are typically 260-290°F (127-143°C) and pH from 3 to 5. Stoichiometric reaction of the feed materials would result in a solution having a pH of about 4. This takes place in a neutralization reactor of which several designs exist. The outflow from the reactor usually enters a surge tank (also called a rundown tank) and thence is stored in large bulk tanks for shipment as 83% AN or for mixing with urea solutions. If higher concentrations of liquid AN or solid material are being produced, the 83% solution is subsequently evaporated in a falling film evaporator or similar process. Usually the resultant partially dried material leaves the evaporator at 95% or greater concentration and is sent to a tall prilling tower where the pure solid material is produced. In the past, some plants would solidify the material on a stainless steel belt (Stengel process).

Following crystallization, the material is coated with an antihygroscopic material and either packed in bags or stored in bulk form, ready for shipment.

Ammonium nitrate is available in various grades and mixtures. Pure ammonium nitrate is rarely used because of its hygroscopicity. Fertilizer-grade and blasting-agent ammonium nitrate are coated with clay, diatomaceous earth or very small amounts (less than 0.2%) of liquid fats or oils to control moisture absorption. They contain a minimum ammonium nitrate concentration of 99%. Ammonium nitrate is frequently mixed with limestone which makes it less sensitive to detonation. This is mainly an European practice, not done in North America. Such mixtures are known as cal-nitro, nitrochalk, ammonium nitrate lime (ANL), or ammonium nitrate dolomite (AND).

3.1.2 Ammonium Nitrate Mixed Fertilizers

The main nutrients in mixed fertilizers are nitrogen, phosphorus and potassium. Mixed fertilizers are available in various grades, usually designated by three numbers (8-6-4, 12-12-12, 20-10-5, etc.). The numbers express percent of available nitrogen (N_2), phosphorus as phosphate (P_2O_5) and potassium as potash (K_2O), in that order.

Note: The percent of available nitrogen is not the same as percent of ammonium nitrate. For example, 100% ammonium nitrate is 34-0-0 fertilizer.

These main nutrients are obtained from various components in the mix:

Nitrogen: ammonia, ammonium nitrate, ammonium sulfate, urea, sodium nitrate, ammonium chloride or ammonium phosphate.

Phosphorus: calcium phosphate or ammonium phosphate.

Potassium: potassium chloride or potassium sulfate.

3.2 Hazards

3.2.1 Solid Ammonium Nitrate

Ammonium nitrate undergoes a variety of decomposition reactions, varying from endothermic breakdown into ammonia and nitric acid, to detonation yielding water, nitrogen and nitrogen oxides plus about one-third the energy of TNT.

Ammonium nitrate fertilizer is regulated in Class 5. 1, Oxidizing Materials, by the US Department of Transportation (Title 49 – Code of Federal Regulations). This tracks the UN Recommendations on the Transport of Dangerous Goods, a code which many nations are adopting in whole or part. In NFPA 400, Hazardous Materials Code, ammonium nitrate is considered a class 1 oxidizer in Chapter 15. Chapter 11 also deals specifically with handling and storage of ammonium nitrate.

AN is noncombustible but is a strong oxidizer capable of supporting combustion of numerous substances. When heated, it yields oxygen or oxides of nitrogen, which intensify combustion.

AN when mixed with fuel oil (sometimes called ANFO) makes a blasting agent for mining and similar uses. The TNT equivalence of ANFO can be 50% and higher depending on additional additives. The so called "explosive grade" AN is usually lower density material than fertilizer grade but otherwise is not markedly different than fertilizer grade. The ANFO mixture could be prepared at the blasting agent user site or may be prepared at a plant near the AN manufacturer. ANFO and other blasting agents should be evaluated using Data Sheet 7-28.

Conditions for detonation vary widely and are not known precisely, but detonation is promoted by severe shock or heating under confinement. The explosion hazard is increased by organic material such as oil, sulfur, grease, charcoal, and combustible dusts. In the presence of moisture, copper reacts with ammonium nitrate to form tetramine cupric nitrate, which is very sensitive to impact and can trigger an explosion. Acids tend to promote ammonium nitrate decomposition.

The addition of inert material such as other fertilizer ingredients or limestone tend to reduce the tendency for detonation. Concentrations below 60% ammonium nitrate should not detonate, but a mixture of ammonium nitrate and ammonium sulfate is hazardous down to 40% ammonium nitrate.

Available data shows that AN as prepared today (post-1945) is insensitive to explosive decomposition under normal storage conditions *as long as it is not contaminated* especially by oils or similar organic materials. Explosion losses of note in the past were due to the presence of substantial amounts of organic materials in the coating, on the order of 1-2%, or other organic contamination (for example, lift truck oils, fuel spills or rubber belt conveyor debris). The newer manufacturing methods and coating materials have significantly reduced the hazard. There have not been any significant explosions with uncontaminated materials in recent history.

Burn tests of lots in the several ton range have not resulted in any explosive decomposition. In addition there have been a number of fire incidents involving uncontaminated AN that have burned but not resulted in explosions. Amounts involved exceeded 50 tons (45 tonnes). As the tonnage increases however, there could be factors that could result in an explosion. In fact, there are cases where it has exploded, but with many extenuating circumstances. There are numerous instances where several tons exploded that were part of a "1000's of tons" pile but the majority of the pile was not involved.

Even with the involvement in an exposure fire, for example, the bags in which it is packed, in small lots, there is little likelihood of anything other than burning. Small lots would be amounts up to 50 tons (45 tonnes). A separation of at least 10 ft (3 m) is sufficient to define lot size.

AN is an oxidizer and it will increase the burn intensity of other combustibles but it is not combustible. It is very important that the storage area be exceptionally clean, and that any broken bags and spilled material be disposed of immediately.

3.2.2 Liquid Ammonium Nitrate (LAN)

3.2.2.1 Background

The potential for explosions in solid AN has been long recognized. Until recently the potential for an explosion in liquid AN has not been of great concern. However, research and loss history now demonstrates that explosions can occur in liquid materials if correct conditions of sensitization, confinement, and concentration in combination exist.

In addition, production of solid AN for fertilizer use has gradually been replaced by liquid solutions. Many facilities no longer make solid products or now make a combination of solid and liquid products. However, all facilities that produce AN, whether solid or solution, have a liquid phase step in the process.

Given the very large number of operating ammonium nitrate plants worldwide and the many years of operation without significant explosion events, it can be assumed that the potential for an explosion in AN solutions is very low.

3.2.2.2 Research

Imperial Chemicals Industries (ICI) conducted tests on nitrate/water solutions between 80 and 100% concentration in temperature ranges between 110 and 185°C (230 and 365°F). The tests were carried out in containers with only moderate confinement. The primary conclusions were:

- only a powerful initiator, such as RDX explosive, produced detonation initiation in AN solutions
- there appeared to be minimum critical levels of temperature and concentration below which initiation did not take place. At atmospheric pressure, ICI concluded that these levels are 90% concentration and 150°C (302°F) temperature.

The US Bureau of Mines carried out tests on molten AN (100% concentration) in steel tubes and glass beakers at temperatures of 180, 200, and 220°C (356, 392, 428°F). Only at the highest temperature could the AN be detonated.

TNO (Netherland Organization for Applied Scientific Research), under contract to the Dutch government, conducted research on AN solutions to determine hazard of transporting these solutions in road and rail tankers. The tests were carried out under strong confinement in steel pipes. Tests were conducted on solutions varying from 80% AN in water to 99.9% solutions, and at temperatures ranging from 126 to 230°C (259 to 446°F). The solutions were all pure; that is there was no purposeful contamination (sensitization) of the solution. The explosion was initiated by an explosive charge. The conclusions of these tests were:

- 99% solutions of AN produce high speed detonations (velocity = 2000 m/sec) at temperatures above 205°C (401°F) when strongly confined. Fragmentation of the tube was evidence of a high order detonation.
- Solutions as low as 80% produced lower order explosions (1150 m/sec) at temperatures as low as 126°C (259°F). The tube containment did not fragment at these levels, indicating no detonation occurred.
- Low velocity detonations are possible in AN solutions confined in pipes but not in large vessels such as tanks (due to the absence of wall effects).
- During transport in tanks, no detonation can occur in AN concentrations below approximately 95% or below solution temperatures of approximately 150°C (302°F).

Over a five year period ending in 1982, the Department of Mining Engineering at Queen's University, Kingston, Ontario, Canada, conducted a series of tests on solid and liquid AN to better understand its propensity to detonate under accidental conditions. This study was under contract to the Canadian Fertilizer Institute and others.

The principal conclusion was that the shock sensitivity of ammonia nitrate, whether liquid or solid, is a function of density, which is a direct function of temperature. The higher the temperature, the lower the density and the greater the potential for shock detonation. AN solutions and molten AN both have lower densities than solid materials. Further, aerated (bubbling) solutions are further decreased in density and sensitized. Finally, AN solutions or molten AN are most sensitive when contaminated by copper.

Other testing showed a combination of aluminum and zinc with molten AN caused a violent decomposition whereas aluminum or zinc alone had no similar effect.

3.2.3 Ammonium Nitrate Mixed Fertilizers

Fertilizers containing 60% or more ammonium nitrate or 40% or more ammonium nitrate mixed with ammonium sulfate have the same potential detonation hazard as described in Section 3.2.1 for ammonium nitrate.

Lower concentrations of ammonium nitrate in mixed fertilizers have shown a tendency for fuse-type decomposition or "cigar burning" which gradually spreads through a pile of fertilizer. This is not "burning" as such. No flames are produced unless paper, oil or other organic material is present. The decomposing material does not usually get hot enough to glow. Hot, toxic gases are given off and combustible material present may become ignited.

The tendency of a mixed fertilizer for fuse-type decomposition is promoted by the following:

1. Ammonium nitrate must be present to decompose and provide the heat and gases.

2. Chloride tends to act as a catalyst.

3. There must be a rigid porous matrix which withstands the high temperatures produced. (A higher concentration of ammonium nitrate tends to melt, which stops the decomposition reaction).

The reaction can be initiated by heat which results in the endothermic decomposition:

$$NH_4NO_3 \xrightarrow{heat} NH_3 + HNO_3$$

The more volatile ammonia is driven off. The nitric acid remaining increases the acidity of the mixture in the area. Together with the chloride present, this tends to promote exothermic decomposition reactions such as:

$$NH_4NO_3 \xrightarrow{H+} N_2O + H_2O + \text{heat and } 5NH_3 + 3HNO_3 \xrightarrow[Cl-]{H+} 4N_2 + 9H_2O + \text{heat.}$$

The heat produced causes decomposition of adjacent ammonium nitrate making it acid, and the reaction progresses gradually through the pile at a rate of a few feet per hour, generating temperatures of 500-1000°F (260-540°C).

The composition of a given fertilizer mix which will undergo fuse-type decomposition can be determined experimentally. Figure 1 and Figure 2 show the area of decomposition for ammonium nitrate-ammonium phosphate-potassium chloride and ammonium nitrate-ammonium sulfate-potassium chloride mixes, respectively. The ammonium sulfate mix appears to be more subject to fuse-type decomposition because it has a lower pH (more acidic) than the phosphate mix.

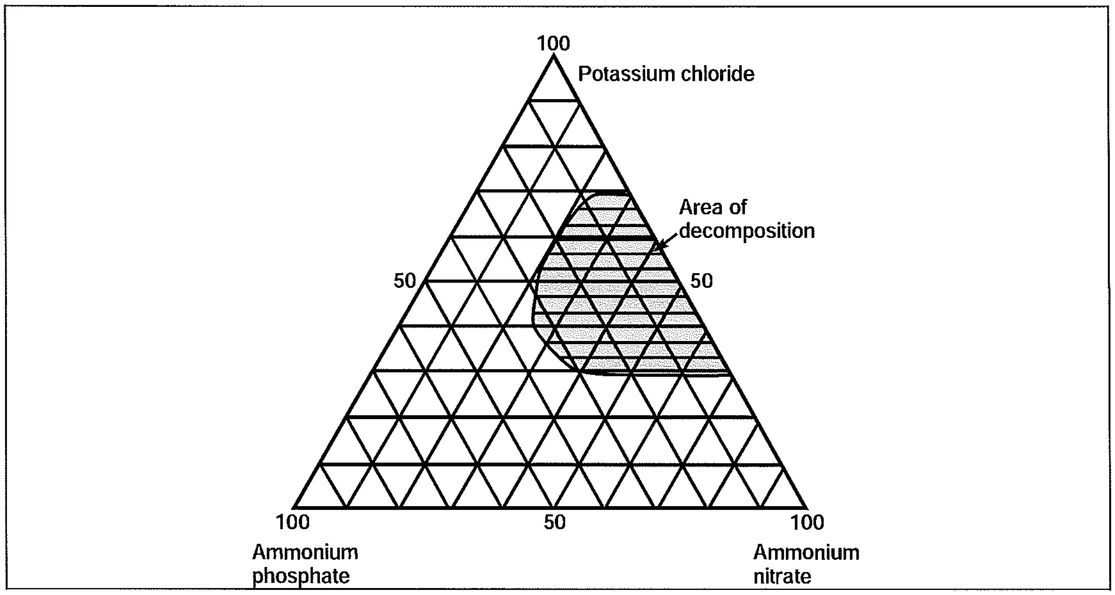


Fig. 1. Area of Fuse-type Decomposition in Mixtures of Ammonium Nitrate, Ammonium Phosphate and Potassium Chloride.

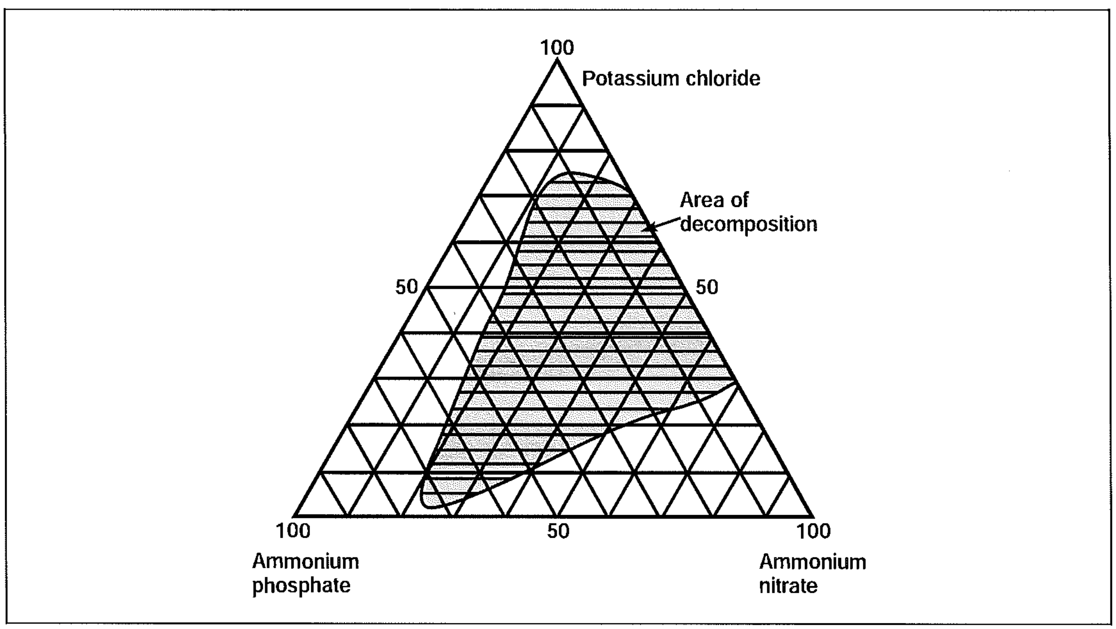


Fig. 2. Area of Fuse-type Decomposition in Mixtures of Ammonium Nitrate, Ammonium Sulfate, and Potassium Chloride.

The decomposition can start from localized heating, such as a hot light bulb, a blasting attempt, or an external fire. If the whole pile is at a high temperature, it can undergo a spontaneous decomposition reaction or fume-off. This hazard exists mainly in storage bins or driers in process areas.

A standardized test for determining the potential for fuse type decomposition is the Trough Test. UN Test S.1 (Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Part III, Subsection 38.2.4, United Nations).

A 6 × 6 × 20 in. (150 × 150 × 500 mm) trough of stainless steel wire gauze is filled with fertilizer and heated at one end with two laboratory burners or a 250 W electric heating element. Heating is applied until decomposition of the fertilizer is well established and propagation of the front is observed. Heating is discontinued. After about 20 minutes the distance the decomposition has progressed is measured and if it has traveled the length of the trough, the fertilizer is considered as subject to fuse type decomposition.

3.3 Loss History

In the last century there have been about 12 explosions reported as involving storage of solid AN. Four involved ships containing bagged AN and two involved railcars of AN that blew up. There were about 10 other events involving AN in various stages of the manufacturing process involving methods not currently used in the manufacture.

Of the 6 non-transportation explosions, four possibly involved quantities exceeding 100T (91 tonnes) of bulk AN reported as exploding.

In 1921 in Oppau, Germany reportedly as much as 10% of storage of 9 million lb (4 million kg) of mixed ammonium nitrate/sulfate could have exploded while being loosened by explosives. It was also reported that high explosives may have been hidden in the pile and data from this incident is suspect. (see 3.4.1.1)

In 1918 in Morgan, WV, a series of explosions at an artillery manufacturing plant reportedly included destruction of a warehouse containing 4000 T (3600 tonnes) of AN that left a 150 ft long by 30 ft (45 by 9 m) deep crater. Reportedly, artillery shells landing in and exploding in the AN were considered the initiator of the AN explosion.

In 1973 in Pryor, OK a warehouse containing 14,000T (12,700 tonnes) of bulk AN caught fire and eventually exploded. Reports suggest the quantities of 3T (2.7 tonnes) up to "perhaps 10% of the mass" exploded. Most realistic estimates are under 30T (27 tonnes).

In 1942 in Belgium a reported pile of 150 — 200T (136 – 181 tonnes) of bulk AN blew up while being loosened by explosives while a 15 T (13.6 tonnes) pile, 80 ft (24 m) away, did not.

In 1961 in Norton, VA a 20T (18 tonnes) pile of AN blew up in a blasting agent manufacturing plant.

In 1966 in Mt. Vernon, MO a 50T (45 tonnes) pile of bagged AN blew up after being ignited by a nearby fire.

3.4 Illustrative Losses

3.4.1 Solid Ammonium Nitrate Explosions

3.4.1.1 Explosive Charges Used to Break up Caked Ammonium Nitrate/Sulfate Blend Causes Pile to Detonate.

A pile consisting of 4,500 tons (4000 tonnes) of a blend of 45% ammonium nitrate with ammonium sulfate exploded during blasting to break up caked material. About 16,000 explosive charges were fired into this mixture without incident, but this time a more powerful explosive was used. The plant was demolished and 600 people were killed. (Oppau, Germany, 1921, Not FM Global insured.)

3.4.1.2 Explosion of Ammonium Nitrate destroys Steamships Grandcamp and High Flyer.

In 1947, the steamship Grandcamp exploded about one hour after fire was discovered in a hold containing 2,300 tons (2090 tonnes) ammonium nitrate fertilizer (wax-coated) in paper bags. About 40 hrs. later, the steamship High Flyer, which was docked near the Grandcamp and also loaded with about 900 tons (815 tonnes) of bagged AN exploded. Brands from the Grandcamp fire/explosion apparently ignited storage in the hold of the High Flyer. Five hundred and eighty-one people were killed and more than 4000 injured.

3.4.2 Fuse-Type Decompositions

3.4.2.1 Water Ineffective in Controlling Decomposition of Bulk Fertilizer Storage.

Decomposition started in the bulk storage of 47,000 tons (42000 tonnes) of 12-12-12 fertilizer. Water was immediately played on the decomposing mass with hose streams, but had no apparent effect in controlling decomposition. Several thousand gpm of water were applied for approximately 10 hours before bringing decomposition under control. The fertilizer was almost completely consumed, and the building severely damaged. Total property damage exceeded $1,000,000. (South Point, Ohio, 1957, Not FM Global insured.)

4.0 REFERENCES

4.1 FM Global

Data Sheet 7-0, *Causes and Effects of Fires and Explosions*
Data Sheet 7-11, *Belt Conveyors*
Data Sheet 7-28, *Energetic Materials.*
Data Sheet 7-43, *Loss Prevention in Chemical Plants*
Data Sheet 8-9, *Storage of Class 1,2,3,4 and Plastic Commodities*

4.2 NFPA Standards

NFPA Standard 400, *Hazardous Materials Code*, Chapter 11, 2013.

4.3 Other

1. *Explosion Hazards of Ammonium Nitrate Under Fire Exposure*; U.S. Department of Interior, Bureau of Mines, Report of Investigations 6773; 1996

2. *The Explosion Hazards of Ammonium Nitrate and Ammonium Nitrate Based Fertilizer Composition*; The Department of Mining Engineering, Queen's University, Kingston, Ontario; Nov. 1982

3. *Danger Aspects of Liquid Ammonium Nitrate, Part I - Detonation Properties, Part II - Thermal Stability*; Report M3038; Prins Maurits Laboratory TNO, The Netherlands; Nov. 1979

4. Center for Chemical Process Safety (CCPS), *Plant Guidelines for Technical Management of Chemical Process Safety.*

APPENDIX A GLOSSARY OF TERMS

FM Approved: References to "FM Approved" in this data sheet mean a product or service has satisfied the criteria for FM Approval. Refer to the Approval Guide, an online resource of FM Approvals, for a complete listing of products and services that are FM Approved.

Ignitable Liquid: Any liquid or liquid mixture that is capable of fueling a fire, including flammable liquids, combustible liquids, inflammable liquids, or any other reference to a liquid that will burn. An ignitable liquid must have a fire point.

APPENDIX B DOCUMENT REVISION HISTORY

October 2013. Editorial corrections, the correction of the NFPA code references on ammonium nitrate and updating the information on hazard testing of fertilizer blends of ammonium nitrate with other components (fuse decomposition).

April 2013. Changed references from Data Sheet 7-42 to 7-0 reflecting the use of a non-TNT model for vapor cloud explosion evaluations.

January 2012. Terminology related to ignitable liquids has been revised to provide increased clarity and consistency with regard to FM Global's loss prevention recommendations for ignitable liquid hazards.

January 2000. This revision of the document was to provide a consistent format.

September 1998. Document was revised to incorporate new information on liquid ammonium nitrate hazards.

March 1977. Document was updated from information provided in the *Handbook of Industrial Loss Prevention*. This data sheet was revised to incorporate material on mixed fertilizers containing ammonium nitrate. Other important changes were: a) the establishment of 60% ammonium nitrate as the concentration above which detonation is considered possible (40% if mixed with ammonium Sulphate); b) the addition of sprinkler system design and water supply specifications; and c) the explanation in more detail of fuse-type decomposition of mixed fertilizers.

APPENDIX C NFPA STANDARDS

NFPA 400, *Hazardous Materials Code*, Chapter 11 covers the storage and handling of ammonium nitrate and fertilizers containing 60% or more ammonium nitrate. There are no serious conflicts with NFPA 400.

MULTIFAMILY DOCUMENT & PAYMENT RECEIPT

TDHCA | Deliver to: 221 E. 11th St., Austin, TX 78701 | Mail to: PO Box 13941, Austin, TX 78711-3941

(This receipt does not attest to the sufficiency of documentation to fulfill Program requirements.)

Development: The Courtyard Apartments   Owner: Church Street Housing, L.P.

Contact: Sara Reidy   Email: sreidy@ess-email.com   Tel: 2149410089

TDHCA Application Number	TDHCA Date/Time Stamp
15029	

Select Program of Documents/Payments Submitted (note: HTC = Housing Tax Credits)

[X] 9% HTC (Competitive)   [ ] 4% HTC - Tax Exempt Bond Issuer: ________   [ ] HOME

Indicate All Documents Submitted

[ ] Pre-Application   [ ] Market Study   [ ] Phase I ESA   [ ] Site Design & Dev. Feasibility Report

[ ] Application   [ ] Appraisal   [ ] PCA/CNA   [ ] Primary Market Area Map

[ ] Waiver Request   [ ] Community Revitalization Plan   [ ] Community Input   [X] Other: Challenge

Describe Payment

Check Amount: $ 500.00   HTC Application Fee: ________ X ________ = $ -

Check Number: 11057   (full app only)   # of Units   Per unit fee   App. Fee

Check Amount: ________   [ ] Non-Profit or CHDO   ________

Check Number: NP Discounted Fee

Describe any special circumstances:

NOTE: Housing Tax Credit Program Applicants that are CHDOs or Qualified Nonprofit Organizations and requesting a fee reduction, must attach a copy of their CHDO certificate or evidence of 501(c)(3) or (4) status to this receipt.

3/26/2015
Date   Applicant Signature   Staff Initials

[X] Check this box to request a copy of the staff-initialed receipt.

Attach Check Here

DATE:03/26/2015 CK#:11057 TOTAL:$500.00***** BANK:HCHP, LLC(4001ba41)
PAYEE:Texas Department of Housing & Community Affairs(texdep01)

Property	Account	Invoice - Date	Description	Amount
4001	14600-000	032615 - 03/26/2015	The Courtyard Apts	500.00
				500.00

THIS CHECK IS VOID WITHOUT A PURPLE & BLUE BORDER AND BACKGROUND PLUS A KNIGHT & FINGERPRINT WATERMARK ON THE BACK - HOLD AT ANGLE TO VIEW

11057

Bank of America

16-66/1220

VOID

HIGHRIDGE COSTA HOUSING PARTNERS, LLC
330 West Victoria Street
Gardena, California 90248
424-258-2800

Date 03/26/2015

Amount $500.00*****

**** FIVE HUNDRED AND 00/100 DOLLARS

VOID

TO THE ORDER OF

Texas Department of Housing & Community Affairs
221 East 11th Street
Austin, TX 78701

⑈11057⑈ ⑆122000661⑆ 1453004541⑈