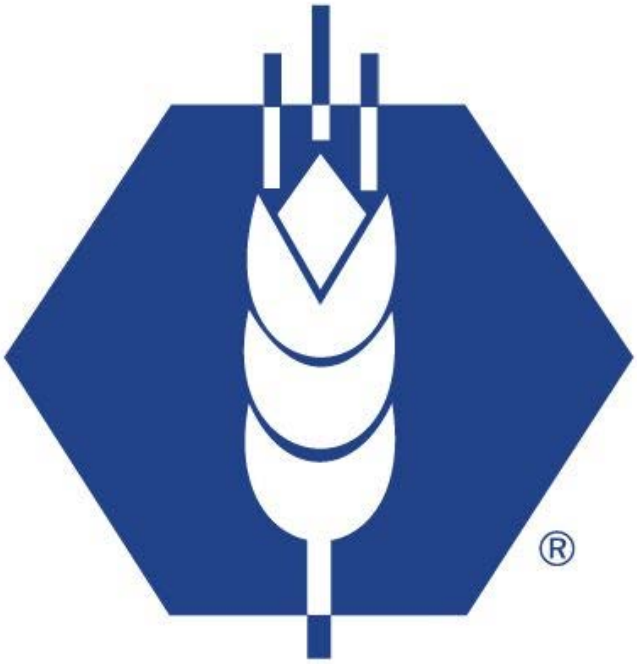
NGFA Firefighting Manual

A Guide for Operators of Grain Handling Facilities and Fire Department Officials



Author: Jim Seibert, Director, Safety Education and Training

Editors: Jess McCluer, Vice President, Safety and Regulatory Affairs
David Fairfield, Senior Vice President, Feed Services

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS

Special thanks to Brian Corderman, Farmers Coop and David Noel, Purdue Agribusiness for their time and effort in assisting to revise the manual. Their subject matter expertise played a critical role in the modifications that were made to specific sections of the document.

INTRODUCTION

This **Firefighting Manual** contains information for operators of grain handling facilities and firefighters on emergency and firefighting procedures. The contents of the manual are primarily intended to address planning for and fighting fires in grain elevators. However, the information has significant applications for feed mills, processing plants, flour mills and other facilities that store and handle bulk agricultural commodities. Chemical fires also are addressed briefly, which has applications for fertilizer and chemical plants.

This manual is intended to be used as a **guide** to develop grain handling facility firefighting procedures. Each grain handling facility is unique in its layout, design, construction, operations, equipment, and personnel. Therefore, each warrants individual consideration when firefighting plans are established. Such plans should be a mutual effort between the facility's management and the fire officials of the district in which the facility is located.

It would benefit both facility management and fire officials to read and be familiar with the contents of this entire manual, since the information conveyed in each chapter affects both parties. Chapters I and III of this manual contain information intended primarily for fire department officials and personnel. Chapter II and the Appendix provide guidelines for managers of grain handling facilities. Chapters IV and V contain information pertinent to both fire department officials and facility managers.

Chapter I reviews the design and construction of various types of grain handling facilities, including storage bins, and receiving, handling and loadout equipment. Areas within the facility that present potential fire hazards also are identified.

Chapter II addresses firefighting equipment and fire protection systems that can be installed in a grain handling facility to enhance fire safety.

Chapter III discusses preplanning for fire departments, including the importance of fire officials familiarizing themselves with grain handling facilities in their districts; the elements of a fire department preplan, including special hazards that may be present in a grain handling facility and special equipment needed; and training of firefighters.

Chapter IV addresses methods and procedures for fighting fires. Unique challenges associated with fighting fires in specific areas and equipment within a grain handling facility are discussed, including bearings, bucket elevators, conveyors, dryers, concrete bins, and steel tanks. This chapter also examines chemical fires.

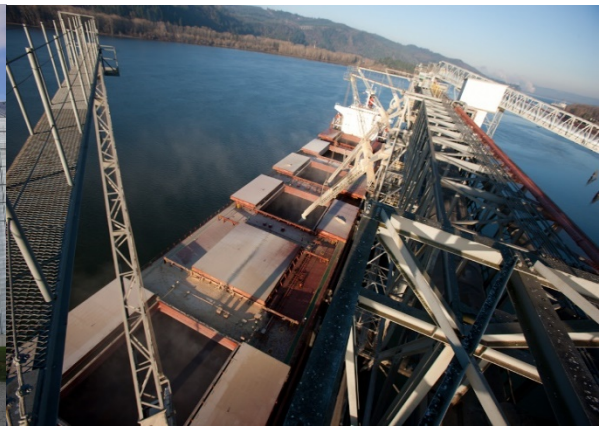
Chapter V briefly discusses the responsibilities of both facility management and fire officials during a fire emergency; crowd control; and media relations. The role of disaster response agencies also is examined.

The **Appendix** to this manual presents the components of a self-inspection/preventive maintenance program for fire prevention. Welding and cutting permit systems and procedures are discussed.

Chapter I
Grain Handling, Storage, and Processing Facilities

This chapter provides a basic description of the types of grain handling and processing facilities for personnel who are not familiar with facility design and construction, operations and the types of equipment used to convey and process grain. Recognizing and understanding potential hazards in facility design, construction, and operations are essential to effectively respond to a fire emergency.

As shown in the photos below, there are numerous ways in which grain handling facilities are designed, constructed, and configured. Each facility can present unique challenges in protecting against fires and during firefighting.



Types of Grain Handling and Processing Facilities

Grain handling storage facilities are categorized as country elevators or terminal elevators, and supply grains and oilseeds to processors or end users. Country grain elevators are designed to receive grain by truck or other farm vehicles directly from producers, and in some cases other local grain elevators. Although country elevators currently continue to expand storage and operational capacity, they are typically smaller in size. Operations in country elevators include receiving, drying, cleaning and storage. Country elevators typically ship grain to terminal elevators, processing facilities, or load cargo containers for export.

Terminal grain elevators are typically much larger in size, operational and storage capacities than country grain elevators. These elevators receive grain from a combination of trucks, barges, and/or railcars. They have the capacity to dry, clean, blend and store grains prior to shipping. Inland terminal elevators generally ship grain to other inland elevators, export elevators, or grain processors by truck, rail, or barge. Export terminal elevators primarily load grain onto ships for export.

Grain processing facilities encompass manufacturers of feed, food, and fuel products. These facilities receive and store grain and oilseeds from country and terminal grain elevators for further processing. Grain processing facilities include, but are not limited to, feed mills, flour mills, soybean and ethanol processors, and pet food manufacturers. In addition to grain receiving and storage operations, processing facility operations may include drying, cleaning, sorting, crushing, extracting, flaking, milling, pelletizing, bagging, packaging, and loading processed products into containers or ships for export.

Grain Facility Design and Construction

Grain handling facilities are designed in various configurations and sizes. Traditional design consists mostly of enclosed wood and concrete construction. While most facilities designed with wood are no longer in operation, there are still a small number in existence. In the traditional design, grain conveying equipment is located inside of the enclosed facility. In contrast to the traditional design, the modern facility is an open structural design with most conveying equipment located outside. Modern facilities are constructed primarily of concrete and steel. Traditional and modern facility design and construction can be found in both country and terminal grain elevators and feed mills, with many facilities employing both types of construction and design.

Grain Storage

Concrete bins used for grain storage are mostly constructed of slip- and jump-form construction techniques. Bins constructed in this manner tend to be tall, vertical cylinders and commonly range from 25 to 90 feet in diameter. The heights of these bins range from 90 to 120 feet.

Many facilities have bins that are attached together during construction. The spaces located between bins, known as interstitial bins, also can serve as storage areas.

Concrete annex bins constructed in a similar manner as the main facility may provide additional storage capacity. Annex bins are built adjacent to the main facility structure and generally do not have dedicated equipment to elevate grain. Generally, these concrete storage bins are constructed together and may have interstitial bins. Annex bins utilize a gallery on top of the bins and a tunnel under the bins to house grain conveyance equipment.

Steel storage tanks may be 25 to 200 feet in diameter and have 30 to 100 feet sidewalls.

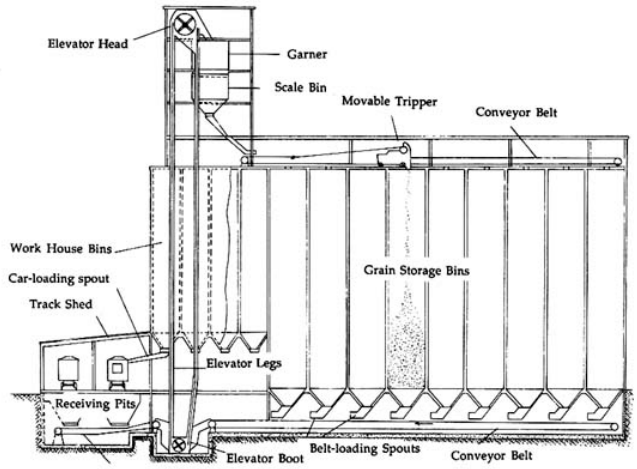
Flat storage buildings also may be used to store grain and resemble large warehouses. These storage buildings may have concrete, blacktop, or wooden floors. Either portable or permanent grain handling equipment may be used to place grain in these buildings. Grain often is removed from these structures with a front-end loader and/or a conveying system.

Grain Receiving, Handling and Load out

Grain typically exits the land carrying vessel into a dump pit or a shallow conveyance system. Grain from the dump pit or shallow conveyance system is transferred by gravity or conveyor (e.g., horizontal belt or drag conveyor) to a bucket elevator (also referred to as a "leg"). The grain is then elevated to the top of the facility by the leg. The leg can be located inside or outside the facility structure and have capacities from 1,000 to 80,000 bushels per hour. The top section of the facility enclosing the bucket elevator is referred to as the "headhouse." Country elevators can have a headhouse height of 150 feet, while headhouses of terminal and export facilities can reach a height of more than 200 feet.

Depending upon design, grain in the facility may be directed to a conveyor belt for distribution to the appropriate bin. Conveyor belts range in width from two to six feet and may operate at 500 to 1,000 feet per minute. The area enclosing the conveyors often is referred to as the gallery, bin floor, or "Texas House." The mechanism used in the gallery area to remove grain from the conveyor belt into the bins is referred to as the "tripper" or "plow." This device is moved along tracks on the bin floor until it is situated above the particular bin which is to be filled.

Other facilities may use a series of conveyors and distributor turnheads to place grain into the bins, rather than have conveyor belts run the entire length of the bins. Using a



Source: Occupational Safety and Health Administration

conveyor/distributor turnhead system eliminates the need for the enclosed gallery and the moveable tripper.

If the facility design includes bins located in an annex, a distribution point from the main facility structure would deliver grain to a conveyor(s) for distribution to the appropriate annex bin.

Grain is removed from concrete bins by gravity flow through spouts in the basement or tunnel of the annex. A horizontal conveyor belt or drag conveyor at ground level or in a basement or tunnel moves grain to the bucket elevator, where the grain is re-elevated and directed by distributor spouts to trucks, railcars, or barges; to a different storage location; to grain dryers; or to further processing.

Discharge bases for steel bins typically are of two different styles – cone bottom or flat bottom. As implied, a cone bottom consists of a cone at the base of the bin that may be either in ground or above ground. For in-ground cones, an auger system typically conveys grain out of the bin to other conveyance equipment. Above-ground cone bottoms discharge by gravity through a gated opening in the bottom of the cone. The discharge is connected to various types of conveyance equipment under the bin.

Flat bottom steel bins have a system of sump holes positioned in the floor above the conveyance system, and grain discharges through the sumps by gravity. When the grain stops flowing by gravity, the remaining grain is moved via sweep auger/conveyor, manpower or other mechanical means. The sump holes have gates that open and close to control the grain flow. The gates can be manually, hydraulically, or electronically opened. The discharge conveyance system can be either built into the floor or a crawl space/tunnel under the floor. The conveyance system can be auger, drag or belt conveyors.

For large steel bins, auxiliary equipment, such as front-end loaders and auger-type conveyors, often is needed for complete removal of the grain because these bins may be separated from the main storage area.

Many facilities have grain cleaning, screening equipment, and dryers to maintain grain quality and extend storability. Since grain dryers have a large open-flame combustion chamber, there is the potential for small operational fires. Because of this, dryers typically are located outside of an enclosed structure.

Equipment operation and grain movement in large, modern grain handling facilities may be remote-controlled from a control room, load out room, or management offices in a building

separate from the grain handling facility. The control area may contain equipment monitors, grain temperature monitors, bin status information and video monitoring for selected areas of the facility.

Potential Fire Hazards

Conventional firefighting techniques are not always applicable to fires occurring in grain handling facilities, causing unique problems for firefighters. Grain and grain dust fires must be approached with extreme caution because of the potential for an explosion or other problems that can arise when applying water. (Chapter IV presents specific firefighting guidelines for grain handling facilities).

There are many potential heat sources in a grain handling facility, some of which can be directly exposed to grain, grain dust or other flammable materials. Potential ignition and heat sources include:

- Overheated bearings.
- Sparks from foreign metal material.
- Lightning strikes.
- Slipping belts within grain conveying equipment.
- Misaligned shafts, pulleys or other parts within grain conveying equipment.
- Friction from foreign metal objects rubbing inside conveying equipment.
- Belts rubbing leg or conveyor casings.
- Improper welding, cutting or hot work.
- Faulty electrical equipment.
- Improper actions by personnel, such as failure to observe smoking restrictions.
- Out of condition grain.
- Use of sparking hand tools, such as shovels, scrapers, and picks.

The major areas and equipment within or external to a facility that can present potential fire hazards are discussed in the following sections.

Grain Dryers

Grain dryers operate at temperatures above 140°F to reduce the moisture content of grain to enhance its quality and storability. They commonly are fueled by natural gas, propane, steam, or fuel oil and powered by electric motors. Grain dryers normally are equipped for automatic operation and shutdown in the event of overheating.

A common dryer malfunction is plugging of the grain flow, which can result in grain or foreign material smoldering within the dryer. This can result in a dryer fire and/or the conveying of smoldering or hot grain to a storage bin.

Bucket Elevator/Leg

The bucket elevator or leg is one of the most difficult locations in which to fight equipment-related fires. The bucket elevator has three main moving parts inside its casing. These parts are commonly known as the tail pulley, head pulley and the belt. Grain flow within a bucket elevator can generate significant amounts of airborne dust, making bucket elevators a location where initial or primary explosions can originate.

Some bucket elevators are equipped with pneumatic dust control systems that remove dust from inside the casing and convey the collected dust to a dust holding bin, while others may be designed so that white mineral oil, soybean oil, or other vegetable oil can be sprayed on the grain stream as a dust suppression. A bucket elevator typically has access panels near the base (boot area), the top (head section) and at various intervals throughout its casing. Explosion doors may be required throughout the vertical distance of the bucket elevator on the upward and downward side. Specific explosion-rated bolts may also be present to secure these doors for release in case of an explosion within the bucket elevator casing. The head pulley cover known as the “bonnet” is to be secured with a chain in case of explosion, so that the bonnet does not fly off creating additional hazards.

Ignition sources in bucket elevators may include:

- Friction between the head pulley and the belting.
- Friction caused by the belting or metal buckets rubbing or striking the casing because of misalignment.
- Malfunctioning bearings.
- Friction resulting from foreign objects (e.g., stones, metal).
- Flammable materials that may be present (in addition to grain and grain dust), including:
  - Plastic buckets.
  - Belt material (rubber or PVC).
  - Lining in spouts.
  - Bearing lubricants.

Grain Processing Equipment

A wide variety of other equipment can also pose potential fire and explosion risks in grain processing facilities. This equipment may be used to sort and process grain and oilseeds for further food, feed, or fuel purposes. This type of equipment includes, but is not limited to, cleaners, sorters, hammermills, roller mills, pellet mills, extruders, grinders, and mixers. Many of the high-speed processes associated with this equipment require the use of pneumatic dust control systems that extract the dust created from processing and convey it to a dust holding bin.

Galleries and Tunnels

Galleries and tunnels also can be the sites of potential fire hazards. These areas of a grain handling facility can be equipped with either horizontal conveyor belts or drag conveyors. Conveyors have main drive rollers at either end of the conveyor, as well as bearing-mounted rollers between the end pulleys supporting the conveyor belt. Conveyors may be either open or enclosed in a sheet metal casing.

Fires in galleries and tunnels may result from:

- Malfunctioning bearings.
- Friction between the conveyor belt and its frame or casing.
- Friction between the conveyor belt and the drive pulleys.
- Burning material on a conveyor.

Grain Bins and Flat Storage

Grain stored in bins or warehouses also represents potential fuel for a fire. A bin fire may result from:

- Filling the bin with smoldering grain.
- Ignition of stored grain by an external heat source, such as welding or a buried light bulb.
- Spontaneous combustion of grain, or grain-related material that has gone out of condition.
- Electrical faults.
- Malfunctioning reclaim equipment.
- Issues with structural integrity causing moisture from the ground or roof to leak in and cause grain to go out of condition.

Since grain is a good insulator, bin fires may not be detected immediately. In addition, bin fires may be located in sections of bins not easily accessible by conventional firefighting measures. In some cases, smell is the best way to identify a smoldering fire in a bin.

Electrical Equipment

Grain handling facilities contain numerous electric motors, lights, fans, and other types of electrical equipment. Electrical equipment can be a potential ignition source, especially if equipment is poorly maintained or used inappropriately.

Transformers generally are located outdoors but can be located inside at some facilities. Relays and circuit control devices may be located in a totally enclosed motor control center separated from other parts of the facility. These rooms, particularly if not located apart from the facility, may be kept under positive air pressure to help prevent dust from entering.

Wiring, normally in conduit, runs throughout the facility to lighting and motors. The electrical components are to be dust-tight or designed for Class II, Division 2 locations. In extremely dusty areas, electrical components are to meet Class II, Division I specifications.

For offices located in dusty environments, wiring, space heaters, coffee pots or other appliances not approved for Class II, Division 2 locations may be present when a positive air pressure system is used.

Combustible Materials in Storage Areas

As in any industrial setting, storage areas for flammable materials can represent a fire hazard. Flammable materials frequently used at grain handling facilities may include:

- Pesticides and fumigants.
- Dryer fuels (propane, fuel oil or natural gas).
- Hexane.
- Gasoline or diesel fuel.
- Lubricants, such as grease or oil.
- Cleaning solvents.
- Mineral oil for dust suppression.

Fires in these areas can be particularly dangerous because of the potential for explosion and/or release of toxic vapors or gases. There also is the possibility of toxic fumes being emitted from burning plastic containers used to hold flammable materials. When possible, smaller sized containers should be stored in fireproof cabinets.

Chapter II

Firefighting Equipment and Protection Systems

Installing firefighting equipment at grain handling facilities greatly increases the effectiveness of firefighting efforts during an actual fire emergency. This chapter provides a basic description of firefighting equipment and protection systems that grain handling facilities should consider using.

Portable Extinguishers

Portable fire extinguishers are effective in the first few minutes of a fire while it is in the incipient stage. Three types of portable fire extinguishers commonly used in grain-related industries are:

- Pressurized water – Effective in extinguishing "Class A" fires involving ordinary combustibles, such as wood, paper, cloth and some plastics.
- Dry chemical – Effective in extinguishing "Class A, B, and C" fires involving ordinary combustibles, flammable liquids, greases, oils, and energized electrical equipment.
- Carbon dioxide – Effective in extinguishing "Class B and C" fires involving flammable liquids, greases, oils, and energized electrical equipment.

Careful attention should be given to locate portable fire extinguishers, so they are readily accessible and immediately available to employees in the event of a fire. The minimum suggested placement for Class A extinguishers is one extinguisher located on each floor near exits, provided the travel distance to an extinguisher for personnel is no more than 75 feet. Class B extinguishers should be located with a travel distance for personnel no more than 50 feet from the flammable liquid hazard they are intended to protect. Other key buildings, such as motor control centers that house energized electrical equipment, should have Class C fire extinguishers located near exits to these buildings.

Extinguishers should be properly mounted, labelled with their contents and application, free from obstructions, and outfitted with dust cover protection where necessary. They should be visually checked monthly to ensure they are fully charged and operable and have maintenance checks annually.

Employees should be trained annually on where extinguishers are located and how to use them to extinguish small fires.

Water Sources

When water hydrants are installed, they should be situated to provide coverage of all outside parts of the facility. Hydrants should not be located too close to the facility; a minimum of 75 feet should be provided between hydrants and the facility structure or they may be inaccessible during an emergency because of debris or heat. Water supply connections at ground level and fire department connections should be clearly marked.

Dry standpipes installed at the facility improve firefighting by providing pressurized water to hard-to-reach areas. Water to the standpipe may be supplied by fire department pumper equipment. Standpipes should have 2.5-inch outlets reduced to 1.5-inch couplings for hose lines at each level. The length of hose provided at each hose station should be at least 150 feet and enable water to be supplied to the farthest point on the floor with a straight or fog nozzle.

Hose nozzles that release both straight and fog streams should be provided. Hoses should be inspected regularly for mildew, cuts, and abrasions. Periodic hydrostatic tests should be conducted to determine if hoses and fittings leak under pressure and all standpipes should be flowed annually to ensure that they are free of debris. All outlets should be covered with threaded caps to keep out debris.

When a facility is located in an area without an adequate water source, provisions should include a water shuttle system with the local fire departments. This system could include the surrounding fire departments shuttling water through tankers/tender trucks to the site. Another option is to arrange for private companies to haul water to the site. If the water sources to refill are far away, a local river, pond, or other waters located nearby may potentially be used to refill tankers/tender trucks.

Suppression / Venting / Isolation Systems

Active Suppression Systems used to prevent fires and explosions are designed to detect and respond to pressure changes associated with the combustion process. When combustion occurs within an enclosed space, pressure rises quickly. Detectors utilized by the suppression system monitor pressure rises and activate the system when pressure reaches a predetermined level. Once activated, the system injects a pressurized mixture of nitrogen and a suppressant agent, such as sodium bicarbonate, into the enclosed space. The suppression system also signals the process control system associated with the equipment to shut down to prevent further hazards or damage. The suppression system must be reset, and the extinguishing agent suppressant powder and actuators refurbished prior to resuming normal process operations.

Explosion suppression systems can be installed to discharge automatically in enclosed equipment, such as bucket elevators or bag filter houses, in the event of a fire or explosion. Proper engineering, installation and acceptance testing is critical to the reliability and efficiency of these systems. Successful operation is highly dependent upon detection and actuation time and the resultant gas concentration.

Explosion venting can be used to limit damage associated with fires and explosions. An explosion vent or rupture panel is a safety device used to protect equipment and structures from excessive, internal explosion-related pressures by means of pressure relief. An explosion vent is designed to open at a predetermined pressure allowing the explosion and flames to exit the equipment or structure being protected. Explosion venting is an economical method to limit damage associated with an explosion, but it does not prevent the explosion itself.

Flameless explosion venting includes a flame arrestor element to extinguish flames during the venting process. This design allows venting of indoor equipment and may also be utilized to enhance the safety of outdoor applications.

Physical or chemical isolation consists of using active mechanical barriers or chemicals to limit the spread of combustion and reduce the potential for an explosion. If chemical isolation is used, it also may be necessary to employ mechanical barriers to prevent the spread of chemical suppressants to unwanted areas or other equipment. When using mechanical barriers on handling or process equipment, it also is strongly advised to isolate both the inlet and outlets of equipment to prevent the spread of combustion to other parts of the facility.

Detection Systems

Smoke detectors are most useful when located in offices and control rooms to alert occupants to a fire. Detectors should be located at ceiling level, at least one foot from the point where the ceiling meets the wall. Detectors must be tested and properly maintained to be effective. Research has shown that currently available, “off-the-shelf” smoke detectors have minimal use elsewhere in a facility because of unfavorable airflow and other conditions.

The human nose is a very effective smoke detector. An alert employee very often is the key to early detection and control of fires that may occur.

Other Firefighting Equipment

Miscellaneous equipment that is easy to obtain and useful when fighting small fires should be strategically located at key areas of the facility. This equipment includes:

- Clean steel garbage can with lid and a shovel. Small amounts of burning material can be safely scooped into the can and removed.
- Bucket of sand for smothering small fires.
- 50 feet of 3/4-inch garden hose with compatible couplings to water outlets located near grain dryers.
- Water-absorbent blanket material or tarpaulins.

Chapter III

Preplanning for Fire Departments

Close cooperation between local fire officials, emergency agencies and facility management are an essential ingredient for a successful fire and emergency action plan. Fires and emergencies in grain handling facilities are unique compared to those that occur in other structures and may require special equipment and techniques. A coordinated effort between facility management and fire and emergency response agencies is necessary to ensure the most effective and safest means to deal with fires, explosions and other emergencies are developed and used.

This chapter identifies steps that fire department personnel should take to become familiar with grain handling facilities and prepare training and reference materials related to fires.

Some steps that fire department personnel can take to prepare are to:

- Visit the facility.
- Develop written emergency plans.
- Train firefighters and facility employees in techniques for approaching and controlling grain-related fires.
- Establish mutual aid plans with other fire departments, including arranging for the availability of special equipment.

Facility Visits

A walk-through of the facility is an excellent way for fire officials to become familiar with its design and unique operations, and to initiate or continue close communications with facility management. When an actual emergency arises, the on-scene fire official may not have the time to refer to written material to become familiar with the facility. Instead, he or she may have to rely on knowledge obtained during the site visit.

The main objectives of a facility visit are to:

- Become familiar with the structure and operations of grain handling facilities.
- Identify potential problems, such as inadequate water supplies or obstacles to advancing hose lines.
- Obtain drawings of site and floor plans, access and egress routes, and gas and electrical lines.
- Learn about explosion hazards.
- Identify special equipment and rescue operations that may be needed and what is available at the facility.

Special Hazards

Special structural and operational hazards that firefighting personnel may encounter should be identified during the facility visit. Such hazards may include:

- Bin and floor openings, such as passenger elevator and manlift shafts.
- Roof and bin tops that may not be equipped with rails to prevent falls.
- Low overhead clearances or other structures, such as ladder safety cages, that may impede passage of firefighters carrying self-contained breathing apparatus or other equipment.
- Storage areas for chemicals, propane, ammonia, gasoline, or diesel fuel.
- Potential differences between the facility's emergency action plan and the fire department's written emergency plan.

Written Emergency Plans

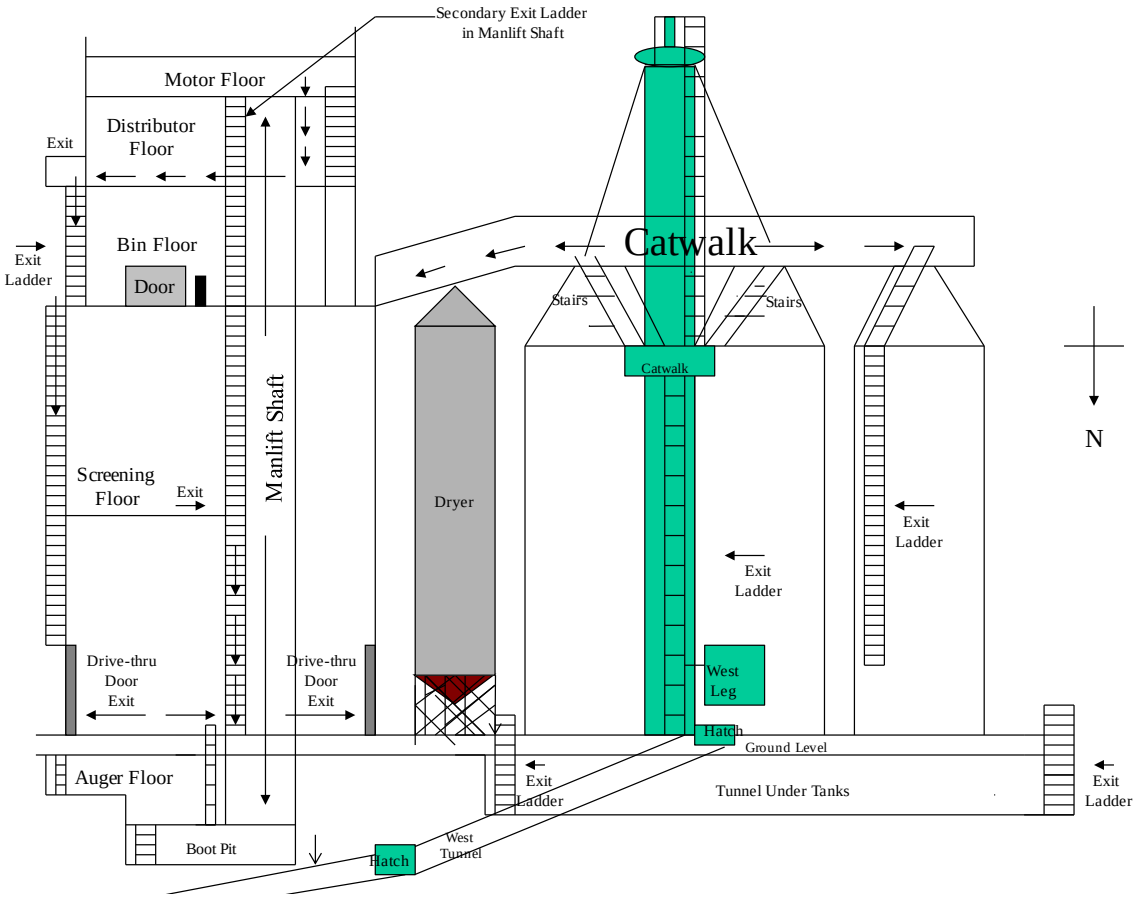
Layout drawings of the facility are the most important component of a fire department's written emergency plan. Much of the information may be obtained from facility management and during site visits. Any written material developed should be available to emergency response crews at the fire station, plant entrance or both.

Layout Drawings

Fire officials should keep the following information on file and have it available at the fire scene:

- Schematics of city or county water lines and supplies for the grain handling facility's area. (Insurance carriers' or construction drawings may help.) Alternate sources of water, such as wells, ponds, streams, and industrial water tanks should be identified and discussed with the facility manager.

- Site and floor plans showing:
  - The general facility layout.
  - Gas and electrical lines, connectors, and shutoffs.
  - Fire lanes and entrance gates that should be used.
  - Dry standpipe system layout.
  - Plans for advancing hose lines, particularly to upper floors.
  - Alternate sources of water, such as rivers, ponds, and bays, from which water can be drawn and tankers refilled.
  - Egress and access route locations and limitations.
  - Hazards, such as floor openings, manlifts, ladders and stairways.
  - Normal workstation locations.
  - Storage areas for fumigants and flammable materials.



Training of Firefighters

Firefighters should be well trained and familiar with the unique hazards involved when fighting fires in grain handling facilities. If improper procedures are used, a minor incident can become a major disaster.

Training should include a review of grain handling operations and procedures to follow when fighting various types of fires and their likely locations. Such training should be followed up with a drill to improve or revise procedures as needed. (Chapter I of this manual addresses facility design and operation and discusses the major potential fire hazard areas. Chapter V contains information on procedures for controlling different types of fires.)

Mutual Aid

Local fire departments should examine their pre-established mutual aid plans to ensure that such plans address the special contingencies that may arise from grain handling facility fires and explosions or other emergencies. Many states have task forces set up that include specialized rescue teams and equipment.

Elements that should be considered include:

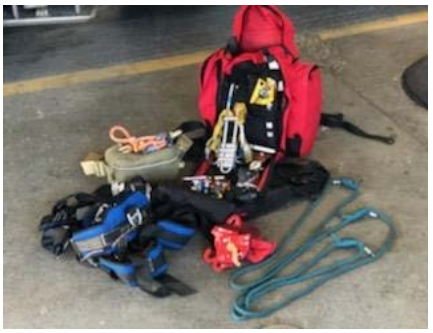
- Making advance arrangements for joint response of several fire departments and emergency medical services to grain handling facility alarms.
- Coordinating responding agencies (e.g., police, county sheriff, rescue), through the fire scene commander, to reduce congestion at the scene.
- Covering of vacated territories by outside fire departments when local department resources are engaged.
- Making advance arrangements to obtain specialized types of equipment that may be required.

Special Equipment

Specialized firefighting and rescue equipment that may be required at a grain handling facility during a fire emergency include the following:

- Aerial ladders, hoists, cranes, boom, jibs, helicopters, and other hoisting equipment for rescue or moving emergency equipment. (Height requirements should be obtained from the facility manager.)
- Heavy steel and concrete cutting equipment.
- Additional water pressure or pumper capacity.
- Fog and stream nozzles.
- Couplings for equipment compatibility (e.g., connections, hydrants, and standpipes).
- Inerting equipment and supplies of carbon dioxide or nitrogen.
- Equipment for drafting water from rivers, ponds, bays, or other areas.
- Descent devices, including basket stretchers.
- Self-contained breathing apparatus.
- High-angle rope rescue equipment.

Although not considered specialized equipment by definition or by original design, mobile equipment, such as portable conveyers, skid steers, loaders and trucks, has proven to be a valuable resource when moving smoldering fires away from a facility.



Chapter IV

Controlling Fires in Grain Handling Facilities

Circumstances and events often dictate what must be done to control a fire at a grain handling facility. This chapter contains information for both facility employees and firefighters about handling different types of fires.

Serious fire situations usually will call for one of two responses:

- An orderly facility shutdown, including proper equipment shutdown, closing of fire doors, and shutting off electricity and fuel.
- A “cut-and-run’ evacuation.

While the first response allows some fire-prevention steps to be taken, the second assumes that the fire already is severe enough to prevent employee intervention. Decisions regarding an ordered evacuation should be made by facility management.

Management should establish clear, written procedures for sounding alarms, evacuation, and firefighting. Generally, employees should be instructed to report the fire or sound the alarm before starting any firefighting procedures. Once employees have exited a building with open flames, they should not reenter the structure to fight the fire.

A major concern when fighting a grain handling facility fire is the potential for explosion. When grain dust is stirred up into a cloud and exposed to high temperatures, such as those occurring during a fire, an extremely hazardous condition exists which could result in an explosion. When bringing a fire under control in an enclosed area, steps should be taken to avoid putting grain dust into suspension in the air in the presence of flames or high temperatures.

Approaching a Fire

It is important to follow a few basic steps when confronting a fire in a grain handling facility. The way in which a small fire is handled could determine whether the situation is controlled successfully or results in a major incident. These basic steps should be communicated to all facility employees. The extent to which the following actions should be pursued will vary depending upon the particular situation. The person faced with the situation must rely on his or her own knowledge and judgment.

If a facility employee is physically located in an area where smoke, flame or odors are present, the following actions should be considered. Fire conditions will determine the order of these steps.

- Notify management about details of the fire.
- Attempt to determine the exact location and extent of the fire. Use extreme caution in opening equipment inspection doors if fire is suspected inside.

- Shut down any equipment operating in the area and disconnect power if possible.
- Obtain nearest fire-fighting equipment.
- Attempt to extinguish burning material or manually remove it from the site in an enclosed container. **Never stir up grain dust in the presence of flames**.
- If the fire cannot be controlled, evacuate the area immediately.

Reporting a Fire

The fire department responding to a call can be more effective if it knows what to expect at the emergency scene. Basic information that should be reported to the fire department includes:

- Caller's name.
- Facility address or location.
- Type of emergency (e.g., fire or explosion).
- Specific location of the emergency (e.g., leg, bin, dump).
- Whether personnel are trapped or injured and how many.
- Materials involved (e.g., dryer fuel, grain, chemicals).
- Extent of the emergency (e.g., explosive materials nearby, high winds, injuries, fire out of control).

Types of Fires

Small, localized fires often can be controlled effectively by employees using firefighting equipment on hand. However, it is important to report or sound the alarm and advise the nearest fire department even if the fire is assumed to be under control. In addition, whenever a small fire is encountered, shut down nearby operating equipment and disconnect power lines.

Three options can be used for extinguishing small fires:

- **Smother** the small fire by placing a bucket or damp cloth over the fire or sprinkling it with sand.
- **Place** burning materials into noncombustible containers, cover and remove from the facility.
- **Apply water or a fire extinguisher** to the fire. **Gently** apply water, using a bucket, watering can or hose. Water the surrounding area first, allowing the water to run to the burning material. If it is necessary to use a hose or fire extinguisher, set water at a low flow rate using a fog or spray nozzle, or use an indirect, gentle extinguisher application. **Hose nozzles should be adjusted before water is turned on**. Again, wet down the peripheral area first and gradually move to the high-heat source.

In no event should smoldering or burning dust be disturbed in such a way as to put it into suspension in the air. Dust in suspension poses an explosion hazard when an ignition source is present.

Bearing Fires

A fire ignited by a bearing malfunction will involve burning dust, grease, or oil. In any case, after shutting off equipment, the fire should be smothered so the dust or grease is not scattered. Bearings at the head (top) or boot (bottom) of a bucket elevator or other major load-carrying bearings are the most likely to malfunction and overheat. The location of the bearing - whether it be inside or outside equipment - will dictate the appropriate action to take.

If the fire occurs in a bearing located outside of equipment, cool the bearing and hot surfaces with water taking care not to disturb any dust (see also Belt Conveyor Fires, page 26).

Bearing fires **inside** equipment are more difficult to detect and locate. If the fire is found inside grain handling equipment, stop the grain flow, and direct a gentle application of water toward the bearing, using a fog nozzle so that layered dust does not become airborne. **Use extreme caution when opening enclosed equipment.**

Bucket Elevator Fires

Fires in bucket elevators may result from various ignition sources and involve a number of flammable components as explained in Chapter I. The burning material and cause of the fire will dictate the action required.

In the event of fire, smoke, or heat in the leg:

- Stop the grain flow into the leg and, in most cases, shut down the leg and associated equipment. Never move burning grain in a bucket elevator.
- Limit the number of openings in the leg casing until the fire is located. If possible, shut gates to reduce air flow.
- The fire source or heated areas may be found by touching the casing or looking for metal or paint discoloration.
- Cool heated areas of the leg casing from the outside with water or a carbon dioxide extinguisher.
- Once the casing is cooled, or if the fire's location cannot be detected from the outside, open the leg casing inspection door gradually, as close as possible to the suspected fire areas. Be ready to apply water at low flow rate. **When opening, feel the door first, stand to the side, and stay low.**
- **Do not disturb layered dust.** Extinguishing agents must be applied **gently** inside the leg casing. Use a small diameter hose under low pressure and allow the water to trickle down the side of the casing.

- The boot section should be completely wetted since burning material may have fallen down the leg. Some belting material may “melt” and become fluid when exposed to a flame.
- Check bins or other conveyors that were receiving grain from the troubled area.

Note: Black smoke may indicate burning plastic, rubber or grease and the presence of potentially toxic vapors or gases.

Belt Conveyor Fires

Conveyor belt fires may result from friction between the belt and its frame (casing) or drive pulley; an overheated bearing; or burning material on the conveyor belt itself. Under certain conditions, even flame-retardant or self-extinguishing materials can burn.

The following steps may be taken to control a conveyor fire:

- Stop the flow of grain to the conveyor.
- Stop the conveyor. Be aware that if the cause of the problem is an overheated bearing, stopping the conveyor could cause the stationary portion of the belt near the bearing to smolder. Be ready to apply water or an extinguisher to the bearing.
- If the conveyor is enclosed, close the discharge gates. Locate hot spots on the conveyor casing by looking for discolored metal. Gently apply extinguishing agent or water to cool the heated casing.
- Consider whether to cut the conveyor belt to isolate the fire.
- Gently apply water or an extinguishing agent to the fire. Do not cause any layered dust to become airborne.
- Check bins or other conveyors that were receiving grain from the troubled conveyor.

Note: Black smoke may indicate burning plastic, rubber or grease and the presence of potentially toxic vapors or gases.

Dryer Fires

Most grain dryer fires are operational in nature and can be extinguished routinely by employees following proper operating procedures as directed by the manufacturer. However, severe dryer fires require the assistance of professional firefighters. In the event of a dryer fire, be alert to the potential spread of the fire into the facility.

Fires occur most often when a section of the dryer becomes plugged, and the grain and related material overheats. For this reason, dryers usually are equipped with an automatic shutoff feature to prevent overheating. Dryers also may be equipped with a separate power source for the discharge rolls and emergency dump system so that power for these systems will not be lost if main dryer power is disconnected. Upper areas of dryers frequently have minimal clearance and often are difficult to reach.

Procedures for handling grain dryer fires are as follows:

- Shut off fuel to burners and shut down the dryer and associated equipment.
- Shut down the flow of grain coming into the dryer.
- Discontinue all grain flow into the facility.
- If only a smoldering condition exists, or the fire is small, it may be possible to scoop up the smoldering material from the floor or ledges and remove it from the dryer. A small bucket or jug of water also can be used to extinguish the fire.
- If the burning material cannot be removed manually, activate the emergency dump and water deluge system, if the dryer is so equipped. Or run the grain out on the discharge rolls and extinguish smoldering material with hose lines.
- If the fire cannot be removed from the dryer, use hose streams on the dryer's exterior or gently apply water through screens, panels or holes cut in the sheet metal, being careful not to impair the structure's stability.
- Check all affected areas of the facility for hot material, including receiving bins, conveyors, etc.
- After the fire is extinguished thoroughly empty and clean the dryer. Do not convey hot grain into the facility.

Concrete Bin Fires

A grain or grain product fire in a concrete bin or silo is one of the most difficult to extinguish. Although heat or smoke may be present in the bin, rarely will there be significant flame present. Thus, the fire may not be located easily within the bin. Since grain is a good insulator, temperature extremes also may not always be detected by temperature cables. Two methods of locating hot spots are thermographic photography and a thermometer probe.

Information that may be useful when determining how a bin fire should be handled includes knowing:

- The contents of the bin (grain or grain product type, quality, quantity and length of time in storage).
- Whether fumigants or other chemicals are present.
- The physical proximity of the bin to other structures.
- The structural loading of the bin.
- Areas where hot or damaged grain can be diverted.

Although the most common approach to a fire is to apply water, there is some hazard in using water, particularly in bin fires. If water is used, it should be applied at a very low rate and only where necessary. Pouring water onto a grain fire in a bin is not usually effective except for on small fires. Use caution to avoid disturbing dust on bin walls or on the top or the grain. In addition, a danger of using water on a hot grain fire in a confined space is the possibility of the water reacting with carbon, a product of combustion, to form a potentially explosive concentration of carbon monoxide and hydrogen known as “water gas.”

Thus, some bin fires can be more effectively controlled by removing the oxygen supply to the fire. One method of eliminating oxygen is to seal the bin and inject carbon dioxide or nitrogen into the bin to prevent flames from spreading. This technique will require a 1.5-inch pipe that can reach the top of the bin from ground level.

Procedures for extinguishing bin fires vary with each fire. Some general guidelines are:

- Stop all equipment operating in the area, particularly the system to the troubled bin.
- Seal all openings into the bin, particularly at the bottom and sides to reduce the supply of oxygen to the fire.
- Locate and determine the extent of the fire. Never try to fight a fire from inside the bin.
- Monitor temperatures in adjoining bins.
- Consider displacing oxygen by injecting carbon dioxide or nitrogen into the bin. Where using gas, be sure to monitor for adequate oxygen in areas where employees are present.
- Gently wet down interior exposed walls at the bin top and the grain surface.
- If water is used, apply it to hot spots slowly with a probe or through access holes cut in the bin walls. Structural loading of the bin should be reviewed by a qualified engineer before any holes are cut. (See below for cutting holes.)

If the bin fire cannot be extinguished using the previously listed steps, consider removing the smoldering grain as follows:

- Wet down the exposed bin bottom in the tunnel area of the facility (or side doors if applicable) and all surrounding equipment to inhibit ignition if smoldering grain or flames erupt from the bin.
- Unload the material directly outside through manhole ports or loadout spouts by auger or other means. Never run hot or burning grain from a troubled bin through a bucket elevator or into another bin.
- If necessary, slowly allow grain to exit the bottom onto the floor (in the tunnel), wetting all material exiting the bin. This can be accomplished by:
  - Using a temporary chute to direct grain flow onto the floor.
  - Cutting or otherwise removing the belt to allow the grain to flow directly onto the floor.
  - If it is not possible to have the grain flow directly onto the floor, allow it to flow onto a stationary belt, wetting the grain as it exits the bin and shoveling it off the belt.

Cutting: It is preferable to use doors or other bin openings for access if possible, before resorting to cutting a hole in the structure. If a hole is required, the following precautions should be considered:

- Consult an engineer to ensure that the structural integrity of the bin is not undermined.
- Have firefighters position charged hose lines before cutting an opening in the wall.
- Strategically locate and size the holes so that wall sections are not weakened.
- Be prepared for material to flow out of the bin.
- Do not remove reinforcing rods.
- Clear equipment and debris from the area after cutting so that firefighters will not be endangered.

- Review Emergency and Firefighting Plan.

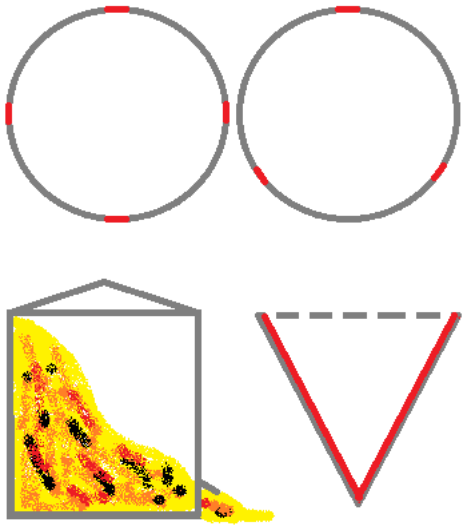
Steel Tank Fires

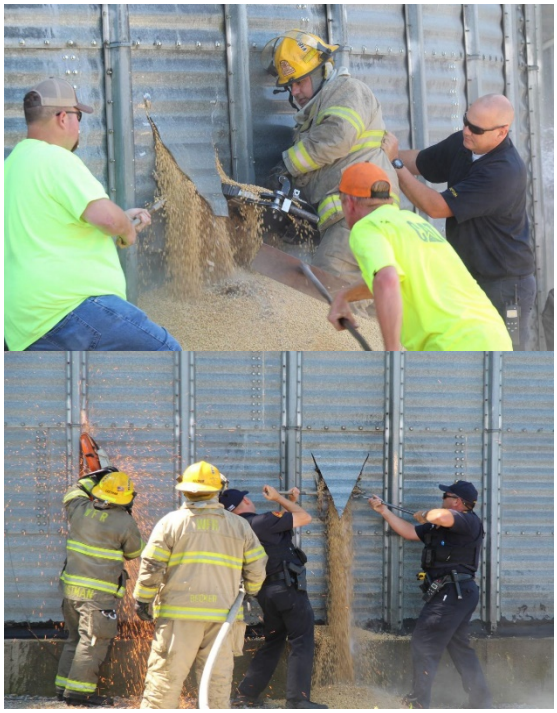
Procedures for combating steel tank fires generally include selective unloading and/or atmosphere inertion (used on small tanks). Pouring water onto a grain fire in a steel tank or bin is not usually effective except for on small fires. Grain burns so hot the water steams off before it can cool the fire. Steam explosions have been caused by pouring too much water into a steel bin. When confronted with a fire in a steel tank, consider using the following procedures:

- Stop all equipment operating in the area, particularly the aeration system and conveyors to and from the troubled tank.
- Establish the location of the fire as specifically as possible using temperature cables or probes.
- For fires in small tanks, seal the bin (manholes, vents, fan openings, etc.) to limit oxygen to the fire and consider injecting carbon dioxide or nitrogen.
- Before grain is removed from the bin, the areas where grain exits the tank, and all equipment should be wet down. Never run hot or burning grain from a troubled tank through a bucket elevator or through another tank.
- Isolate the area of fire by selective unloading of grain. If side draw-offs are present in the tank, or if holes can be cut in the walls (see next section on cutting), begin removing grain located near the fire until burned grain is detected. Slowly allow smoldering grain to flow from the tank, wetting the hot grain as it exits the hole.
- In some steel bins (including flat storage structures), open doors as soon as possible to use manual unloading techniques.

Cutting: As with concrete bins, use existing tank openings, drawoffs, etc., to provide access before cutting an opening in a wall, which should be considered a last resort. If cutting an opening is required:

- Consider installing a slide gate to control the flow of grain exiting the bin.
- Outline the cut to be made by drilling intermittent holes.
- When cutting, avoid structural supports, studs, stiffeners, bolt lines and electrical wiring. Have the area checked or evaluated by a structural engineer.
- Ensure that openings are cut in pre-determined pattern to distribute the grain's pressure evenly. As an example, openings could be cut at the bin's 12 o'clock and 6 o'clock locations followed by the 3 o'clock and 9 o'clock locations. Another cutting pattern could be the 12 o'clock, 4 o'clock and 8 o'clock locations.
- A metal-cutting power saw usually is the best cutting tool to provide a precision opening that is easier to repair. Periodically cool the blade and area being cut by applying water.
- Cut the metal along the studding to provide stability for the saw and for ease of repair. When possible, an entire sheet or panel should be removed.
- After the opening is made, clear the area of debris so firefighters will not be endangered.





Fumigant/Chemical Fires

Fires involving fumigants, pesticides, solvents or plastic products require extra precautions to avoid exposure to or inhalation of toxic vapors or gases. A floor plan of the chemical storage area, a list of the types and classifications of chemicals and pesticides being stored, and material safety data sheets for each chemical should be available and provided to the fire department and rescue personnel. The following precautions should be taken to fight a fire involving chemicals:

- Identify materials involved in the fire. **Some fumigants, such as those generating phosphine, can react rapidly in the presence of moisture, causing exothermic heat and explosive gases or fires.**
- Contact the fumigant, pesticide or chemical manufacturer or poison control information centers for assistance.
- Evacuate areas nearby and downwind. Isolate and patrol these areas to keep spectators out. Chemicals and plastic products can release toxic vapors or gases when exposed to fire.
- Notify neighboring operations or businesses.
- All personnel fighting the fire should wear self-contained breathing apparatus and protective clothing, including boots, turnout coats, helmets, and rubber or neoprene gloves.
- Attack the fire from the upwind side, if possible. Inhalation of smoke or contacting smoke or water runoff from a chemical fire can be hazardous.
- Generally, chemical fires are Class B and should be fought with an appropriate extinguishing agent. In the absence of an extinguisher, some chemical fires can be controlled effectively using sand, dirt, wetted cloth, or some other nonflammable means to smother flames.
- Report any immediate skin, eye, or respiratory irritation, as well as symptoms occurring

within 48 hours after the incident. All personnel involved should be briefed on possible medical problems associated with the chemicals.

- Check closely for chemical leaks after the fire is contained.
- Equipment and protective clothing used at the fire should be cleaned thoroughly with a strong detergent solution. During the clean-up process following a fire involving chemicals, continue the use of any necessary protective clothing.

Chapter V
Controlling the Fire Scene

Facility managers should be aware of how fire control operations likely will occur, who will be present, what problems may arise and what salvage procedures to use in the aftermath of a fire or explosion. Control of an emergency situation should be maintained to prevent confusion and improper actions that may lead to unnecessary injury or property loss.

Fire Control Operations

During a fire emergency, the facility manager and fire official in charge work together to bring the fire under control and assure the safety of employees, firefighters, media, and spectators. Some state laws put the fire official in charge of the scene for firefighting, rescue, and public safety. The appropriate roles of both fire officials and facility management should be established in preplanning meetings with the fire department.

When arriving at the scene of a fire, the fire official in charge will establish a command post in an area outside the danger zone to direct and observe tactical operations. The facility manager should be involved actively in an advisory, cooperative capacity and provide assistance where and when needed. Both the fire chief and manager (or his or her designee) should outline together their main objectives and actions for bringing the fire emergency under control, such as assisting injured personnel, rescuing trapped workers, taking headcounts, and containing the fire.

A staging area should be set up for extra fire department equipment and personnel. Extra crews should remain at the staging area to receive orders from the command post concerning the placement of manpower and equipment.

The facility's emergency action plan should list the actions and responsibilities to be taken by employees. The on-scene facility manager should confirm that all appropriate tasks have been accomplished. Among these actions are:

- The fire command officer has been met upon his or her arrival at the site, and a responsible facility employee is available throughout the firefighting effort to coordinate and assist.
- Employee head counts have been taken quickly and reported so that rescue operations can begin, if needed.
- The facility area, all entrances, and exits have been secured.
- Contact has been initiated and is being maintained with relatives of missing employees.
- The status of power, water, and gas utility (on, off, portable generators, etc.) is being monitored.
- Facility employees and/or security personnel are keeping spectators under control. Only emergency officials and approved employees should be allowed on the scene.
- A company spokesperson is providing briefings to the media.
- Mutual aid arrangements and plans for cranes, helicopters, etc., are in place.

Liaison with Other Outside Agencies

Besides fire department crews, paramedics, and ambulance services, there likely will be other agencies or groups responding to the disaster or emergency call. Representatives of any of the following groups may be present at a fire or explosion scene:

- Occupational Safety and Health Administration (state or federal).
- Chemical Safety and Hazard Investigation Board.
- News media (newspapers, TV crews, radio, etc.).
- Social service groups (Red Cross, Salvation Army, etc.).
- Local disaster or civil defense agency.
- Coast Guard and port officials.
- Law enforcement.
- Insurance officials.

Facility management should consider developing a communications policy with outside agencies and the media and brief employees on the company's policy. A company should consider having a single spokesperson designated to provide factual information as it becomes available. All information from the spokesperson should be cleared by the facility manager or the incident commander before release.

No outside personnel should be allowed in the immediate fire area or danger zone. All press and outside agencies should be briefed at a proper staging area. Anyone needing to contact the facility manager or the incident commander should obtain clearance through the command post.

Salvage

Salvage operations may begin once it is safe to do so without interfering with firefighting or rescue operations. There may be some salvage actions taken during the fire, such as removing trucks and railcars or other easily transportable equipment from the fire vicinity. (No facility equipment should be operated in the presence of a flame or heat source). Insurance representatives can be consulted for help in salvage matters and in contacting salvage companies.

Signs a Grain Storage Structure May Be on Fire:

- Discoloration of Grain.
- Discoloration of Metal.
- Carbon Monoxide Level is High.
- Smoke is Present.

Contact insurance representatives for help in salvage matters.

Appendix
Fire Prevention Programs

There are several steps that facility management can take to reduce the risk of a fire or other emergency at a grain handling facility. These include establishing and enforcing:

- A self-inspection/preventive maintenance program.
- A cutting and welding (hot work) permit system.
- No smoking rules.

Self-Inspection/Preventive Maintenance Program

A facility self-inspection program has two main objectives:

- To detect and prevent hazards.
- To ensure that facility emergency plans are up-to-date and fire protection equipment is operable.

For small facilities, this program may consist of a weekly walk-through by one person. For large facilities, a number of personnel may be involved. A self-inspection program developed at a facility needs to be tailored to that facility because of its unique design, equipment, operation and emergency contingency plans. A program of this type should be developed and maintained by a responsible supervisor familiar with the facility's operations and should include checks on the following:

- **Housekeeping:** Check that excessive grain dust levels are not developing on potential ignition sources, such as bearings, or near locations where explosions are known to initiate, such as bucket elevators.
- **Egress routes:** Check that escape routes are clearly established and well-marked.
- **Established water supplies:** Check hydrant and pump operability and hose and standpipe condition.
- **Fire extinguisher and suppressant devices:** Follow manufacturer's maintenance suggestions.
- **Communications/alarm systems:** Check operability.
- **Flammables' storage areas:** Check for the presence of leaks, spills, and gases.
- **Auxiliary power and lighting operation:** Check operability.
- **Accumulation of debris and waste:** Dispose of properly.
- **Equipment wear:** Check for problems, such as improperly aligned belts, bearing malfunctions, discolored motor cases, etc. (Consult manufacturers' manuals for preventive maintenance programs for specific equipment.)

Control of Smoking

The following guidelines should be included in the smoking policy at a grain handling facility.

- Designate and clearly mark “No Smoking” areas. Enforce this rule strictly with appropriate disciplinary action.
- Allow smoking only in areas that have appropriate disposal receptacles. Base selection of areas where smoking is allowed on safety and employee accessibility.
- Ensure that visitors are well aware of smoking restrictions.

Hot Work Permit System (Cutting and Welding)

A hot work permit system should be used to ensure that all safety measures are implemented, and that adequate fire protection is available near hot work activities. A hot work permit system may prohibit hot work inside, and within a specific distance outside the facility’s enclosed areas. The specific requirements of the permit system should be part of the education program for all maintenance personnel.

Before any hot work is undertaken, determine whether the piece of equipment requiring work can be removed from the facility for the duration of the hot work.

A hot-work permit system should be developed to ensure that:

- Hot work is never performed in the presence of dust or other combustible materials.
- Permission to perform hot work has been obtained from the responsible supervisor and consideration has been given to removing the equipment for which hot work will be performed from the facility.
- Combustibles have been removed or protected from the hot work operation (non-combustible tarpaulins may be used). This should include the removal of layered dust from nearby surfaces.
- All equipment, motors, etc., that could injure the welder, disturb dust, or introduce grain

or grain dust to the work area have been shut off and locked or tagged out.

- A portable extinguisher (or other extinguishing device) of the appropriate class (A, B, or C) is readily available during and after the hot work.
- A fire watch is undertaken by a second employee while the work is in progress and for a minimum of 30 minutes after the work is completed. All areas and equipment associated with the hot work should be monitored for up to four hours by visual walk-through inspections. The person responsible for the fire watch can be required to sign the permit after the watch is over.
- All hot slag is removed carefully when hot work is complete.
- All surfaces are cool prior to restarting any grain handling or work operations that generate airborne grain dust.

Hot Work Permit

Location:_____Date:_____
Area:_____Floor:_____
Nature of Task: _____

_____ Level 1: Drilling, concrete chipping, sand blasting, use of portable electric tools.
(Level 1 Hot Work will be elevated to Level 2 approval if it is performed in conjunction with a Confined Space permit).
_____ Level 2: Welding, cutting, grinding, brazing, or other flame/spark/slag producing activities.

N/A YES NO
_____ Can this work be done without hotwork?

GENERAL PRECAUTIONS TO BE TAKEN (Level 1 and 2)
_____ Welding, cutting equipment, extension cords and power tools inspected and in good repair.
_____ Permission received from required appropriate Level 1 or Level 2 approver.
_____ Proper personal protective equipment to be worn. (i.e., face shield, goggles, gloves).
_____ Employees in the affected area are notified of hot work to be performed.
_____ Area clear of airborne dust.

ADDITIONAL PRECAUTIONS (Level 2)
_____ Combustible floors wet down, covered with damp sand, or metal, or fire-retardant sheets.
_____ Combustible materials or flammable liquids removed from area.
_____ Dust systems servicing the area turned off/locked out.
_____ All wall and floor openings closed and/or covered.
_____ Fire retardant tarpaulins suspended beneath work to collect sparks.
_____ Combustibles moved away from opposite side of walls.
_____ Windspeed acceptable for hot work performed at high elevations.

WORK ON ENCLOSED EQUIPMENT (Level 2)
(Tanks, containers, ducts, dust collectors, legs, etc.)
_____ Equipment interior cleaned of all combustibles and wet down.
_____ Adequate air flow through enclosed equipment to be provided while welding and cutting is done.

PRECAUTIONS WITHIN 50 FEET OF FLAMMABLE LIQUIDS/GAS (Level 2)
(Ethanol rail cars, propane tanks, gasoline/diesel tanks, natural gas lines)
_____ No flammable or combustible vapors present. LEL reading: _____

FIRE WATCH (Level 2)
_____ To be provided during and for 30 minutes after operation (as minimum).
_____ Supplied with extinguishers or small hose.
_____ Trained in use of extinguishers or small hose.

I have personally examined the above area and certify that the checked precautions have been taken.

Level 1 or Level 2 Approver: _____

Date Permit Expires:_____Time:_____

Signed:_____Signed:_____
Contractor Location Manager or Designate

FINAL CHECK
Work area and all adjacent areas to which sparks, and heat might have spread (such as floors above, below, and on opposite side of walls) were inspected at least 2 hours after the work was completed and were found fire safe.

Time Final Inspection Made: _____

Signed: _____
Location Manager or Designate

Hot Work Permit

Note: No welding or torch cutting shall begin until all precautions have been taken and all parties are satisfied that a safe condition exists. The permit is good only for the job being performed and the time listed on the permit. Time cannot exceed eight hours.

1. Location where work will be performed:	
2. Specific equipment to be worked on:	
3. Describe the work to be performed:	
Check each step as completed:	
4. Use only qualified welder.	
5. Inform management and other employees in the facility before hot work begins.	
6. Stop and lockout all machinery at least 30 minutes prior to welding and cutting.	
7. Clean the entire area at least 30 minutes prior to welding and/or cutting.	
8. Block or cover all spouts and floor openings with a noncombustible material	
9. Wet the area with "wet water" or aqueous film-forming foam (detergent water) in order to minimize dust balls.	
10. Post a helper to man an extinguisher in the event of flying hot metal or small fires.	
11. Welder has proper safety equipment such as fireproof gloves, welding shield or goggles, and fire-resistant clothing.	
12. Make a thorough inspection for burning embers and hot metal before restarting operations.	
13. Manager signed the permit.	

14. Permit issued to:	15. Date:	16. Hour:
Permit expires	17. Date:	18. Hour:

I have discussed the above with the manager and have received this permit.

19. Permit holder's signature:	
20. Manager's signature:	
Initial to the right after completion of the hot work and final inspection of the area by the permit holder and manager.	21. Permit holder:
	22. Manager:

Note: The signing of this permit is not a waiver of any rights which an employee has under the law