Assessing Biomass Processing Fire Hazards and Community Fire Response Capabilities
This publication focuses on fire hazards in systems that process perennial grass biomass. Described are the major codes and standards that are applicable to perennial grass biomass systems, the planning that is needed by both industry and fire services, and the capabilities of community fire services that are faced with previously unseen and unknown fire hazards in this new industry. The following list of recommended practices is expanded on in the remainder of this publication.

**Biomass Production and Processing Operators**

- Harvested product, whether stored in the field or in the processing facility, should be separated from trees, vegetation, and all other combustibles by placement in a proper location, and proximal vegetation should be controlled or removed in order to limit potential fire exposure.
- Lanes for fire apparatus should be created for access to fire operations and provide a physical separation from product bags, bales, wagons, trailers, and/or piles. Access lanes should be wide enough to allow two vehicles to pass each other.
- Harvesting and other powered mobile equipment should be equipped with a 10-pound ABC fire extinguisher or automatic fire-suppression system. When not in use, fuel-powered equipment should be separated from raw or finished product in order to prevent the spread of a possible equipment fire to the product or the rapid expansion of fire should a product fire reach a fuel tank.
- Dust-control measures should be followed according to National Fire Protection Association (NFPA) standards 61, 652, 654, and 655. These measures exceed general good housekeeping and maintenance practices.
- Facility operators should consider the use of thermal imaging cameras to evaluate production equipment for overheating problems. This action would recognize potential ignition sources and provide enhanced maintenance operations.
- Facility owners or operators should comply with building codes, fire codes, and all other applicable codes of the authority having jurisdiction as a matter of utilizing best practices.
- Operators should follow the Occupational Safety and Health Administration (OHSA) standards found at 29 CFR 1910, General Industry Regulations, Subpart E and Subpart L for fire prevention plans, emergency evacuation planning, building exits, fire extinguishers, and fire protection systems.

**Community Fire Services**

- Fire services should be trained in the use of Class A foam as a wetting agent to augment limited water supplies. Compressed air foam may be applied for exposure protection of piled, baled, or bagged harvested crops that are threatened during field fire incidents. NFPA 1145: Guide for the Use of Class A Foams in Fire Fighting and NFPA 1150: Standard on Foam Chemicals for Fires in Class A Fuels should be used as guidelines.
- Fire services should consider the use of piercing nozzles to apply water and/or foam solution to control and suppress deeply seated fires in piles, bales, or silage bags of harvested crops. This fire extinguishment tactic has been utilized for all types of baled Class A fuels and is a common practice of fire services.
- Fire services should consider the use of thermal imaging cameras to help locate deeply seated fires, especially in harvested crops, as described above.
- Fire services should consider the use of NFPA 1620: Standard for Pre-Incident Planning and NFPA 1142: Standard on Water Supplies for Suburban and Rural Fire Fighting for guidance in developing pre-incident firefighting plans.
Introduction

A significant hazard for processing facilities of all types, fire has already left its mark on a number of biomass facilities throughout the world. In biomass processing locations, fire and explosion hazards are serious concerns due to the large quantities of dry materials stored and processed, and the presence of very combustible dust.

A very critical need exists to identify fire hazards and risks at farm production, storage, and processing facilities. The specific biomass materials in question are perennial grasses. Other biomass materials are short-rotation woody shrubs such as willow and poplar, which have fire hazards similar to those of the wood chip industry.

Questions relating to the fire hazards inherent in perennial grass biomass storage and production systems focus on the following:

• What fire codes and regulations apply to biomass storage or processing plants located in rural or unincorporated areas?
• What fire preplanning needs must a processing facility, the local jurisdiction, and fire service responders have in place before, during, and following the construction of a biomass storage or processing facility?
• What are the needs of a rural fire service that finds a biomass storage or processing facility located within the fire protection service district?

Fire prevention precautions provide more protection from fire as a proactive measure than the otherwise necessary reactive suppression actions. The main goal of overall fire protection is to either eliminate or mitigate environments where fire is capable of propagating, thus maximizing life safety and minimizing property loss and business interruption.
Codes and Standards

Building codes, fire codes, electrical codes, the National Fire Protection Association standards, and the Occupational Safety and Health Administration regulations are developed by recognizing the need for increased levels of public safety. The regulatory nature of codes and standards function very well with proper application and compliance.

Just as these codes and standards have been applied to business, industry, and numerous other entities, so too is it reasonable to include application to the emerging biomass industry. This is true for no other reason than the fact that the finished products of this industry will be used in any number of ways that fall under the regulatory guidance of the codes and standards in question. Additionally, compliance with existing and applicable codes and standards is valid for the following hazard assessments:

1. Life safety considerations of the activity
2. Property protection from economic loss of product, function, equipment, and/or records
3. Fire threat to adjacent people and property

It is reasonable to expect that the Pennsylvania Uniform Construction Code (PAUCC) or other jurisdictions’ building codes and related fire prevention codes, including the International Fire Code (IFC), National Electrical Code (NEC), and other standards of the International Code Council (ICC) and the National Fire Protection Association (NFPA), be applied to the biomass industry in a nonfarm setting.

Authorities having jurisdiction (AHJ) in the adoption and/or promulgation and the codes compliance processes can be at the state or local government level.

Where production and storage structures and related activities occur in the farm setting, the abovementioned codes and standards generally are not applicable and compliance to them is not required. The “Agricultural Building Exemption” is determined by enabling legislation in each state. A careful review of the definition of the term “agricultural building” and its application is necessary to assess whether or not agricultural buildings are excluded or exempted in a particular state.

Occupational Safety and Health Administration

Federal OSHA

The U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA) regulations are promulgated for worker safety and health considerations. Two situations limiting the application of OSHA regulations are in the “small farm exemption” and businesses employing 10 or fewer full-time employees. Truly, agriculture is not “exempted” from OSHA authority. Farms can be expected to comply with regulations under the “General Duty Clause (GDC)” of OSHA, which is Section 5(a) (1) of the William Steiger Occupational Safety and Health Act of 1970.

Under this clause, employers must provide an employment location free from recognized hazards that may cause serious physical harm or death to employees, and employers must comply with OSHA safety and health standards. Likewise, OSHA indicates that employees are required to comply with safety and health rules. Examples of employee compliance include notifying employers of hazards and wearing personal protective equipment/respiratory protective equipment. The GDC is used when no specific standards have been adopted to address a specific hazard.

An identified fire and explosion hazard is that of combustible dust that is generated in various phases of biomass production. Recently, OSHA and the NFPA have focused heavily on the hazards of combustible dust.

OSHA uses Special Emphasis Programs to address specific problems as they develop. For example, the OSHA Harrisburg, Pennsylvania, Area Office instituted a Local Emphasis Program (LEP) within Pennsylvania in 2003 to address combustible dust issues. This LEP was the result of three dust explosions that occurred in the state within a two-year period.
NFPA 652: Standard on the Fundamentals of Combustible Dust was released in 2015. This new standard covers all materials, including agricultural products, wood products, chemicals, and so on. The standard requires identifying combustible dust flash fire and explosion hazards, conducting dust hazard analysis, and mitigating the risks associated with combustible dust.

With this type of attention to the combustible dust issue, biomass production and storage facilities/operations are very affected by this health and safety concern.

Another relevant and specific OSHA standard, 29 CFR 1910, General Industry Regulations, Subpart E and Subpart L, addresses workplace fire safety. Major fires with tragic loss of life create a long history of workplace fires in the United States. OSHA standards require employers to provide proper exits, firefighting equipment, emergency plans, and employee training to prevent fire deaths and injuries in the workplace. A further discussion of these topics occurs in a later section.

Additional considerations for the combustible dust issue in the biomass industry should include OSHA Subpart R of the General Industry Standard. OSHA Subpart R contains standards for what is considered to be “Special Industries.” Some of those special industries include saw mills, grain-handling facilities, bakery equipment, and pulp, paper, and paperboard mills. These industries share common hazards, but they also have hazards inherent to their particular operations. To date, there are no industry-specific requirements for perennial grass biomass processing operations, but the abovementioned industries have some similar hazards and potential risks. In general, these hazards and risks include the use, generation, handling, and storage of combustible dust.

State OSHA
There are 26 states that administer occupational safety and health programs. These state OSHA plans have received approval to do so from the U.S. Department of Labor. There are differences between state and federal OSHA.

State OSHA exists when a state determines that additional regulation or regulation clarification is needed to ensure employee safety. Programs that are administered at a state level are required to meet the federal regulations. This is the minimum threshold for state programs. A state can adopt more stringent regulations than those of federal OSHA. This variation is permitted to allow states to identify and require regulations that are more suitable to their jurisdiction. This state determination may impact the biomass industry.

Employers who are required to operate by OSHA safety regulations must do so based on either state or federal regulations applied to their jurisdiction. Some state-run plans cover state and local government workers only.

The following is a list of state-run OSHA programs in 2016: Alaska, Arizona, California, Connecticut, Hawaii, Illinois, Iowa, Kentucky, Maine, Maryland, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wyoming. The U.S. Territories of Puerto Rico and the Virgin Islands have jurisdictional plans as well. Pennsylvania follows federal OSHA standards.
Workplace Fire Protection
Businesses operating biomass storage and/or processing facilities must take a multifaceted approach to controlling the fire risk. The following are elements of fire control and prevention.

Fire Prevention Plan
OSHA General Industry Regulations 1910 Subpart E is the basis for the following:
- Stopping unwanted fires from occurring is the most efficient way to handle fire risk. Employers are required to implement a written emergency action plan and a fire prevention plan that are available for employee review.
- Housekeeping procedures for proper storage and cleanup of flammable materials and flammable waste must be included in the plan. Recycling of flammable waste is encouraged. Proper handling and packaging procedures must be included in the plan.
- Procedures for controlling workplace ignition sources such as smoking, welding, and cutting must be addressed in the plan. Heat-producing equipment such as burners, heat exchangers, boilers, ovens, heating units, etc., must be properly maintained and kept clean of accumulations of flammable residues. Flammables are not to be stored in close proximity to these pieces of equipment.
- All employees are to be apprised of the potential fire hazards of their job and the procedures called for in the employer’s fire prevention plan. The plan shall be reviewed with all new employees when they begin their job, and with all employees when the plan is changed.

Building Fire Exits
OSHA General Industry Regulations 1910 Subpart E is the basis for the following:
- Each workplace building must have two means of egress to be used in an emergency requiring evacuation. These exits must be remote from each other.
- Fire exit doors must not be locked or blocked, which would prevent emergency use when employees are in the buildings. Delayed opening of fire doors is permitted when an approved alarm system is integrated into the fire door assembly.
- Exit routes from buildings must be free and clear of all obstructions and properly marked with signage designating exits from the building. Evacuation maps may be posted in proximity to exits as well.
**Portable Fire Extinguishers**

OSHA General Industry Regulations Subpart L, 1910.157, Portable Fire Extinguishers, is the basis for the following recommendations:

- Each workplace building must have a full complement of ABC-type fire extinguishers to handle fire hazards.
- Employees who are expected to use fire extinguishers must be instructed on the hazards of fighting fire, how to properly operate the fire extinguishers that are available, and what procedures to follow in alerting others of the fire emergency.
- Only approved fire extinguishers are permitted to be used in workplaces, and they must be kept in good operating condition. Proper maintenance and inspection of the equipment is required of the employer.
- Where the employer wishes to evacuate all employees instead of having them fight small fires, there must be written emergency plans and employee training for proper evacuation as mentioned above.

**Fire Suppression Systems**


- Properly designed, installed, and maintained fixed fire suppression systems enhance fire protection in the workplace. Automatic sprinkler systems that are properly located throughout the workplace complex are generally the most reliable means of fire suppression. The fire sprinkler system detects the fire, sounds an alarm, and puts water on the fire and related high-heat areas to control the fire at its origin.
- Automatic fire suppression systems require proper maintenance to ensure that they are constantly serviceable. Any temporary disruption of the system, for any reason, requires that the employer provide a fire watch for the affected area. The fire watch must have trained personnel standing by to quickly respond to any fire that might occur. The fire watch activity must be integrated with the employer’s fire prevention plan and emergency evacuation plan.

**Lightning Protection**

- Lightning strikes to an unprotected structure are devastating. Lightning can cause not only extremely serious fire but also significant structural damage and possible loss of life. Other losses may occur from damaged capital equipment, electrical and communications systems, or mission-critical support systems.
- Fires that result from lightning strikes may go undetected due to the location of the strike. For example, suppression systems rarely protect roof and under roof structural areas, which may lead to an uncontrolled fire.
- Lightning protection systems should be designed, installed, and maintained by credentialed professionals to ensure optimum performance of this critical fire protection system. NFPA 780: Standard for the Installation of Lightning Protection Systems is an appropriate guide.

Even with all of the abovementioned standards and regulations, loss control concerns of insurance carriers that insure biomass industry facilities may require additional practices when underwriting the insured properties. This is especially true for business activities that have limited histories and experiences with the fire threat.

As indicated earlier, many of these facilities exist outside the realm of codes, standards, and regulatory oversight. Insurance loss control consultants and underwriters can offer advice for reducing the risks of fire hazards. These may range from critical recommendations to improvements they believe would augment the facility’s insurance program. Insureds that make efforts to minimize
losses and provide safe work environments generally help keep insurance coverages at reasonable costs.

**Capabilities and Needs of Community Fire Responders**

The inherent fire hazards of perennial grass biomass production and storage facilities are a concern for community fire protection services parties. From the perspective of the local fire service, this new type of fire threat poses many questions, including but not limited to the following:

1. What is the nature of this new business and its activities?
2. What are the types of facilities that are utilized for these activities?
3. What are the fire loads of raw, finished, and processing materials used?
4. Are there other potential emergency concerns like hazardous materials, confined spaces, or entrapments?
5. Are the systems and structures of this business regulated for health and safety issues?
6. Does our service have the necessary training and education for emergencies that may occur?
7. Does our service have the necessary equipment and materials to deal with fires or other emergencies at this facility?
8. How does responding to emergencies at the facility affect the safety of the responder?
9. Do the hazards posed by the presence of this business totally eclipse our capabilities to deal effectively with any and all emergencies?

**Preplanning**

Many of the answers to these questions are gained through specific education, training, and pre-incident planning.

Pre-incident planning allows the responders to assess the resources that are necessary to meet the demands of the particular hazard should an emergency occur. Pre-incident planning involves several different but related activities. Fire services should utilize NFPA 1620: Standard for Pre-Incident Planning for guidance in the preplanning effort.

The first need is to develop a good working relationship with the business owner/operator. Needs and expectations can be addressed, discussed, and appreciated by all parties. A great deal of knowledge can be gained by the parties and a greater understanding of the needs of both can be expressed in meetings during facility planning, development, construction, completion, and continuous operation. Efficiency, coupled with responder safety, can be increased when emergency services have current, in-depth information about the biomass operation.

The second activity is to view the building complex during both construction and completion.

This opportunity for examination during the construction phase permits responders to learn about the buildings' construction techniques, building components, and building systems. The facility should also be examined upon completion. This provides a more comprehensive opportunity to gather and document critical information. This second set of activities is known as pre-incident surveying.

The information gathered from these activities must be managed and retained in a detailed form for use in responder training and familiarization, and for the data to be relied on during emergency response actions. The ability to share this information with other responders who may come to assist those who initially respond is crucial. The use of a common preplan, based on accurate information, for all responding parties and the business operator is critical for effective emergency service response. This third activity is very essential.

The last activity is to develop and maintain pre-incident plans. This process involves
officers and responders, and provides information needed to formulate and effect emergency actions in a timely fashion. Pre-incident plans are essential for responder training. Specific tactics and overall strategies for the perceived emergencies that are identified in the preplans can be evaluated. Proper pre-planning prevents poor performance.

Biomass facility operators can provide a significant amount of assistance in the preparation and planning effort of emergency services. This can be in the form of facility locations, special hazards locations, property maps and layouts, access roads, building structural details, floor plans, utility control locations, water supply information, and so forth.

**Training**

Many firefighting and emergency service training programs and courses are available through state and national fire training agencies, but the content of these courses is general in nature and not specific to biomass fire situations. Fire training programs prepare responders with the basic knowledge, skills, and abilities to respond to a variety of community fire problems. Training programs that teach tasks, tactics, and firefighter safety provide fundamental preparation for safely and effectively responding to fire emergencies. Additional courses prepare responders on specific topics such as pre-incident planning, building construction, fire protection systems, officer development, strategic planning, incident management, property conservation, fire prevention, water supply and delivery, agricultural emergencies, hazardous materials control, public fire safety, and so on. Many of these courses can be applied to solving biomass fire hazard problems. The providers of these courses are extensive and include both private and public sector organizations. They operate on a local, state, regional, national, and international basis, and range in capabilities from general topics to highly specialized subjects. Because of the variability of training requirements and sources of training between states, state-level fire authorities should be consulted to find training providers in the locale of interest.

Training courses have associated costs in dollars (e.g., registration fees, travel) and time. Volunteer responders may have difficulty meeting these costs for various reasons, resulting in a gap between training available and training received. The results of this training gap might be that responders are not adequately prepared to respond to fires in biomass operations. Required levels of training for responders vary depending on specific responder responsibilities. These training requirements, and their documentation, are determined by the authorities having jurisdiction and can vary greatly.

Businesses can help to bridge the training gap by assisting with training for their particular facility. This assistance can be offered by sharing the expertise of facility personnel with responders during regular training sessions of the fire companies. Business facilities can host, at their locale, specific courses such as building construction, preplanning, water delivery, and tactics and strategy so that responders can relate what is being learned to the immediate environment. Regular practice drills could be conducted at the facility with the owner’s permission. These are a few ideas that can foster the important partnership between business and emergency responders and enhance the training effort.

**Resources**

The best planning and training must be combined with physical resources. All of the tactical operations that are identified in both pre-incident plans and fire ground incident action plans must be in ample quantities to safely and quickly meet the strategic outcome.
For successful fire control and suppression, the following five resources are needed:
1. People
2. Procedures
3. Apparatus
4. Extinguishing agents
5. Time

These resources are inherently related to and dependent on one another.
When emergency responders find that their fire ground plans eclipse the initial resources of the fire company, additional response capabilities must be added. An effective manner to meet this need is to include the mutual or automatic aid of neighboring fire services for response at the very moment of initial dispatch.

People and Procedures
Fire services from adjacent jurisdictions with proper training, knowledge of the specific preplan, and other capabilities to execute the incident action plan are crucial to fire ground success. Joint training, common communications systems, and standard operating practices of all responding agencies are vital. Adequate numbers of people for initial operations and reserves for extended operations must be a realistic factor for resource deployment in the mutual/automatic aid profile.

Apparatus
The ability to move, pump, and apply water and other extinguishing agents in sufficient quantities is another prime consideration in the evaluation of resources needed to meet the expectations of the pre-incident plan. Apparatus pumping capacity and ability to access the fire incident location are important factors when planning for this resource. Included in the consideration of apparatus is the assortment of hoses, appliances, and auxiliary equipment needed to perform the tactical objective of water movement. Properly trained and experienced operators and mechanical support to maintain apparatus functionality over time must be carefully managed.

Water and Extinguishing Agents
Fire control and extinguishment requires sufficient amounts of water at a flow rate that meets fire conditions. Determining the water supply needed and the rate of water application to control and suppress fire is a great challenge for the fire service in many different settings. The ability to find, move, and apply adequate volumes of water in rural communities is complex but can be carefully estimated and factored into the pre-incident plan. Fire services should utilize NFPA 1142: Standard on Water Supplies for Suburban and Rural Fire Fighting for guidance in the preplanning effort.

Firefighting apparatus will carry limited amounts of water, which will be consumed quickly in the initial fire attack. For sustained operations, other sources of water are needed. These additional water supplies must be properly identified in pre-incident plans. These supplies must be evaluated for volume, seasonal availability, and apparatus accessibility to ensure that the water supplies are reliably available prior to inclusion in the pre-incident plan. Water tanker/tender shuttle operations as a supply source must be evaluated as well.

Biomass facility operators can help to locate, install, maintain, and make accessible suitable water supplies on their properties. Facility operators may work with adjacent property owners to arrange for access to and use of neighboring water supplies that are close by. These actions must be coordinated with responders for their input.

An extinguishing agent, like Class A firefighting foam, has become a great benefit to firefighting operations. Class A foam use in rural locales is a particularly effective additive to water where limited supplies of firefighting
water exists. High-expansion Class A foam has also been used for exposure protection of structures in wildland firefighting activities.

Class A foam concentrate in solution with water can enhance the wetting and cooling of the water when applied to common fuel sources. As a result, available water is used more effectively to create a wetting solution. This technology requires the proper equipment and specialized training to be used successfully. Biomass facility operators and mutual aid fire services may cooperate to provide this option for firefighting.

**Time**
The time element of fire control and suppression is crucial. Assembling proper numbers of firefighters, dispatching remotely located fire apparatus, and garnering adequate supplies of water at the scene of a fire emergency is time consuming. The variability of the time needed to conduct these activities is dependent on travel distances, weather conditions, accessibility of the incident site, time of day, and so forth. To some people, these actions appear to be performed in short order, but during this time period the size and intensity of the fire emergency are growing rapidly. This is especially true when considering the volatility of dry perennial grasses in both raw and processed form. The fire propagation timeline also requires consideration of the time to discover the fire and then to notify responders. All of these time frames become part of the incident timeline. It is important to understand that at this point in the timeline, fire attack and control have not begun.

Where required by code or otherwise installed, automatic fire detection, notification, and/or suppression systems will minimize the uncontrolled burn time at various points along the incident timeline.

All time frames in the total timeline, from ignition point to fire control and suppression, must be carefully evaluated. Early detection and notification of the fire incident, rapid automatic suppression, and prompt dispatch/travel of adequate resources for manual firefighting should receive this evaluation for the purpose of reducing the fire timeline.

The effort of all parties involved to reduce this timeline in a comprehensive manner is vital for developing the resources that are needed for the community’s fire response capabilities. Those parties include not only emergency responders but facility operators, their insurers, and any investors.
Summary
Comprehensive fire protection goals should include preventing fire initiation, preventing life loss and injury if fire does start, confining fire to its location of origin, and extinguishing fire once it does start. These goals should be adopted, shared, and borne by all affected parties.

The outcome of fire hazard assessment is to identify the possibility of unintentional fire incidents, and gauge the potential frequency and consequences of those incidents. In general, the methodology of the assessment is made by reviewing best practices associated with the activity, or by preparing a predictive evaluation of processes and procedures. The latter method is used when there is little experience or history involving the activities or processes being assessed. For perennial grass biomass operations, there is a lack of history and experience regarding farm-level fire safety and response of fire services.

As a result, reviewing best practices of similar industries and activities is a reasonable method of hazard assessment for the perennial grass biomass industry. In addition, following the best practices of general industry can provide a starting point for evaluation. These practices have evolved from codes, standards, and other regulatory requirements. At this time, compliance with existing codes, standards, and regulations to the best extent possible is the best practice for the biomass processing industry.

Similarly, community fire services must analyze their capabilities to meet fire protection goals of biomass facilities. Ideally, there would be no loss of any kind, but from a practical perspective, acceptable levels of loss due to fire may be prioritized as death, injury, and property. By understanding what level of fire protection is desired, and comparing that desired level to the capabilities of the fire service, adjustments can be made to either the goals or the capabilities.

Fire services can improve their capabilities by following best standards and practices, utilizing all available public and private resources, and formulating accurate plans to meet the desired goals. If, in the final analysis, the fire department’s comprehensive level of service delivery and the desired level of fire protection for the biomass industry don’t align, then the acceptable level of loss due to fire may need to be increased.
References


Additional Sources of Information

Code of Federal Regulations (CFR)
U.S. Government Printing Office
732 North Capitol Street NW
Washington, DC 20401
Phone: 866-512-1800
www.gpo.gov

International Code Council (ICC)
5203 Leesburg Pike, Suite 600
Falls Church, VA 22041
Phone: 888-ICC-SAFE (422-7233)
www.iccsafe.org

National Fire Protection Association (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Phone: 800-344-3555

Related NFPA Codes and Standards:
• NFPA 1: Fire Code
• NFPA 10: Standard for Portable Fire Extinguishers
• NFPA 11: Standard for Low-, Medium-, and High-Expansion Foam
• NFPA 11A: Standard for Medium- and High-Expansion Foam Systems
• NFPA 13: Standard for the Installation of Sprinkler Systems
• NFPA 13E: Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems
• NFPA 18: Standard on Wetting Agents
• NFPA 18A: Standard on Water Additives for Fire Control and Vapor Mitigation
• NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
• NFPA 61: Standard for Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
• NFPA 70: National Electrical Code®
• NFPA 551: Guide for the Evaluation of Fire Risk Assessments
• NFPA 652: Standard on the Fundamentals of Combustible Dust
• NFPA 654: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
• NFPA 655: Standard for Prevention of Sulfur Fires and Explosions
• NFPA 664: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
• NFPA 780: Standard for the Installation of Lightning Protection Systems
• NFPA 1000: Standard for Fire Service Professional Qualifications Accreditation and Certification Systems
• NFPA 1001: Standard for Fire Fighter Professional Qualifications
• NFPA 1002: Standard for Fire Apparatus Driver/Operator Professional Qualifications
• NFPA 1021: Standard for Fire Officer Professional Qualifications
• NFPA 1031: Standard for Professional Qualifications for Fire Inspector and Plan Examiner
• NFPA 1142: Standard on Water Supplies for Suburban and Rural Fire Fighting
• NFPA 1145: Guide for the Use of Class A Foams in Fire Fighting
• NFPA 1150: Standard for Foam Chemicals for Fires in Class A Fuels
• NFPA 1620: Standard for Pre-Incident Planning
• NFPA 1720: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Volunteer Fire Departments
• NFPA 1801: Standard on Thermal Imagers for the Fire Service
• NFPA 1901: Standard for Automotive Fire Apparatus

OSHA Standards, Interpretations, and Publications
U.S. Department of Labor/OSHA
OSHA Publications Office
200 Constitution Avenue NW
Washington, DC 20210
Phone: 202-693-1888
Related OSHA standards found in 29 CFR:
• 1903 Inspection, Citations, and Proposed Penalties
• 1904 Recording and Reporting Occupational Injuries and Illnesses
• 1910 Subpart A (General)
• 1910 Subpart B (Adoption)
• 1910 Subpart E (Exit Routes, Emergency Action Plans, and Fire Prevention)
• 1910 Subpart L (Fire Protection)
• 1910 Subpart R (Special Industries)
• 1910 Subpart S (Electrical)

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Supported by USDA NIFA grant #2012-68005-19703.