



# Lusail Real Estate Development Company

## Health, Safety, Security, Environment, Logistics & Quality Department

### Lusail Construction Safety Management Procedure – Fire Protection

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## 1. Description

This element of the LCSMP provides requirements for fire protection on the Lusail Construction Project. This element includes extinguishers, firefighting equipment, and fire warning systems. This element applies to all Lusail personnel, Contractors, Developers, Consultants and Subcontractors working on the Lusail Project.

Fire emergencies have additional considerations and requirements for fire alarming, response, evacuation, and exit routes. These have been integrated into comprehensive emergency response planning for sites found in [LUS-HSE-WG3-446-011](#), Emergency Planning & Response.

Project engineers and designers of planned facilities consult insurance underwriting requirements, local authority building ordinances, and guides such as the National Fire Protection Association (NFPA) in designing and constructing facility fire systems.

## 2. Responsibilities

The Contractor is fully responsible for the pre-planning, development of Method Statements, Job Hazard Analysis, overall safe work planning and implementation. The Contractor's Project Management is responsible for the assurance that all work is planned and conducted according to the pre-planning document, Contractor and Lusail Health Safety & Environment (HSE) procedures and the Qatar Construction Specifications 2010. Should a conflict occur between procedures/standards or requirements the more stringent will apply.

## 3. Definitions

Role	Responsibility
Automatic fire detection device	A device designed to automatically detect the presence of fire by heat, flame, light, smoke, or other products of combustion.
Buddy-breathing device	An accessory to self-contained breathing apparatus (SCBA) that permits a second person to share the same air supply as that of the wearer of the apparatus.
Carbon dioxide	A colorless, odorless, electrically nonconductive inert gas (chemical formula CO <sub>2</sub> ) used a medium for extinguishing fires by reducing the concentration of oxygen or fuel vapor in the air to the point at which combustion is impossible.
Class A fire	Fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials.
Class B fire	Fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials.
Class C fire	Fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.
Class D fire	Fire involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium, and potassium.
Dry chemical	An extinguishing agent composed of very small particles of chemicals such as sodium bicarbonate, potassium bicarbonate, urea-based potassium bicarbonate, potassium chloride, or monoammonium phosphate supplemented by special treatment to provide resistance to packing and moisture absorption (caking) as well as to provide proper flow capabilities. Dry chemical does not include dry powders.
Dry powder	A compound used to extinguish or control Class D fires.

Role	Responsibility
Fire brigade (private fire department, industrial fire department)	An organized group of employees who are knowledgeable, trained, and skilled in at least basic firefighting operations.
Fixed extinguishing system	A permanently installed system that either extinguishes or controls a fire at the location of the system.
Flame resistance	The ability of materials, or combinations of component materials, to retard ignition and restrict the spread of flame.
Foam	A stable aggregation of small bubbles that flow freely over a burning liquid surface and form a coherent blanket that seals combustible vapors and thereby extinguishes the fire.
HFC-227 (FM-200)	An alternative fire suppression system agent for the ozone-depleting Halon 1301 used extensively before 1994. It is also known as heptafluoropropane.
Gaseous agent	A fire extinguishing agent that is in the gaseous state at normal room temperature and pressure. It has low viscosity, can expand or contract with changes in pressure and temperature, and can diffuse readily and distribute itself uniformly throughout an enclosure.
Halon 1211	A colorless, faintly sweet-smelling, electrically nonconductive liquefied gas (chemical formula $CBrClF_2$ ) that extinguishes fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromochlorodifluoromethane.
Halon 1301	A colorless, odorless, electrically nonconductive gas (chemical formula $CBrF_3$ ) that extinguishes fires by inhibiting the chemical chain reaction of fuel and oxygen. It is also known as bromotrifluoromethane.
Incipient stage fire	A fire in the initial or beginning stage that can be controlled or extinguished by portable fire extinguishers, Class II standpipe, or small hose systems without the need for protective clothing or breathing apparatus.
Interior structural firefighting	The physical activity of fire suppression, rescue or both, inside buildings or enclosed structures that are involved in a fire situation beyond the incipient stage.
Local application system	A fixed fire suppression system that has a supply of extinguishing agent, with nozzles arranged to automatically discharge extinguishing agent directly on the burning material to extinguish or control a fire.
Multipurpose dry chemical	A dry chemical that is approved for use on Class A, B, and C fires.
Positive-pressure breathing apparatus	Self-contained breathing apparatus in which the pressure in the breathing zone is positive in relation to the immediate environment during inhalation and exhalation.
Predischage employee alarm	An alarm that sounds at a set time before actual discharge of an extinguishing system so that employees can evacuate the discharge area prior to system discharge.
Quick disconnect valve	A device that starts the flow of air by inserting the hose (which leads from the facepiece) into the regulator of self-contained breathing apparatus and stops the flow of air by disconnection of the hose from the regulator.

Role	Responsibility
Sprinkler alarm	An approved device installed so that any water flow from a sprinkler system equal to or greater than that from single automatic sprinkler results in an audible alarm signal on the premises.
Sprinkler system	A system of piping designed in accordance with fire protection engineering standards and installed to control or extinguish fires. The system includes an adequate and reliable water supply and a network of specially sized, interconnected piping and sprinklers. The system also includes a control valve and a device for actuating an alarm when the system is in operation.
Standpipe systems	<ul style="list-style-type: none"> <li>• Class I: a 2.5-inch (6.3-cm) hose connection for use by fire departments and those trained in handling heavy fire streams.</li> <li>• Class II: a 1.5-inch (3.8-cm) hose system that provides a means for the control or extinguishment of incipient stage fires.</li> <li>• Class III: a combined system of hose used by employees trained in the use of hose operations and that can furnish effective water discharge during the more advanced stages of fire (beyond the incipient stage) in the interior of workplaces. Hose outlets are available for both 1.5-inch (3.8-cm) and 2.5-inch (6.3-cm) hose.</li> </ul>
Small hose system	A system of hose ranging in diameter from 5/8 inch to 1.5 inch that is for the use of employees and that provides a means for the control and extinguishment of incipient stage fires.
Total flooding system	A fixed suppression system that is arranged to automatically discharge a predetermined concentration of agent into an enclosed space for fire extinguishment or control.

#### 4. Portable Fire Extinguishers

Based on the emergency response planning from [LUS-HSE-WG3-446-011](#), Emergency Planning & Response, the Lusail Construction Project is classified as one of three basic types of workplaces:

- If management has chosen to fully evacuate the workplace at the time of a fire emergency and fire extinguishers are not provided, the requirements of this section do not apply to that site.
- If management has chosen to partially evacuate the workplace or the affected area at the time of a fire emergency and has permitted certain designated employees to remain behind to operate critical plant operations or to fight fires with extinguishers, the site is exempt from the distribution requirements of this section.
- If management has chosen to permit all employees in the workforce to use fire extinguishers, the entire section applies.

Extinguishers are distributed as set forth in NFPA 10, Portable Fire Extinguishers.

Members of a fire brigade or employees who remain behind to perform incipient firefighting must be familiar with the locations of fire extinguishers. Therefore, management must locate the extinguishers in convenient locations where the employees know they can be found.

Extinguishers may be maintained in any location that is accessible to employees without the use of portable devices (e.g., ladders).

The selection and distribution of fire extinguishers must reflect the type and class of fire hazards associated with a particular workplace:

- **Class A** (involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials): Extinguishers with water, foam, loaded stream, or multipurpose dry chemical.

- **Class B** (involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials): Extinguishers with Halon 1301, Halon 1211, carbon dioxide, dry chemicals, foam, or loaded stream.
- **Class C** (involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media): Halon 1301, Halon 1211, carbon dioxide, or dry chemical.
- **Class D** (involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium): Extinguishers using water, gas, or certain dry chemicals cannot extinguish or control Class D. Certain metals have specific dry powder extinguishing agents that can extinguish or control this type of fire. Agents that have been specifically approved for use on certain metal fires provide the best protection; however, some “universal” agents can also be used effectively on a variety of combustible metal fires, if necessary. Universal agents include Foundry flux, Lith-X powder, TMB liquid, pyromet powder, TEC powder, dry talc, dry graphite powder, dry sand, dry sodium chloride, dry soda ash, lithium chloride, zirconium silicate, and dry dolomite.

## 5. Standpipe and Hose Systems

Under certain circumstances, acceptable standpipe systems can be substituted for portable fire extinguishers. It is necessary to ensure that any substitution will provide the same coverage that the portable units provide. Because of their limited portability, fire hoses must be spaced throughout the protected area so that they can reach around obstructions such as columns and machinery and so that they can reach into closets and other enclosed areas.

Management must ensure that standpipes are protected so that they can be relied upon during a fire emergency; therefore, the pipes must be protected from mechanical and physical damage.

Management will keep fire protection hose equipment in cabinets or inside protective covers that protect the equipment from weather, dirt, or other sources of damage. Protective covers must be easy to remove or open. Cabinets used to store equipment must be kept free of obstructions and other equipment.

Management must ensure that employees who use standpipe and hose systems can reach the hose rack and hose valve without using portable equipment such as ladders. The use of hose reels is encouraged because one employee can retrieve the hose, charge it, and place it in service without much difficulty.

Both standpipe and hose systems must be designed and installed in accordance with NFPA 14:

- If management elects to provide small hose in lieu of portable fire extinguishers, those hose stations being used for the substitution must have hoses attached and ready for service. If the installation of hose on outlets may expose the hose to extremely cold climates, the hose may be stored in houses or similar protective areas and connected to the outlet, when needed.
- Hose is considered to be unserviceable when it deteriorates to the extent that it can no longer carry water at the required pressure and flow rates. Dry rotted linen or hemp hose, cross-threaded couplings, and punctured hose are examples of unserviceable hose.
- Variable stream nozzles provide useful variations in water flow and spray patterns during firefighting operations and they are recommended for employee use. It is recommended that 100-psi (700-kPa) nozzle pressure be used to provide good flow patterns for variable stream nozzles.
  - The most desirable attribute for nozzles is that the person holding the nozzle is able to shut off the water flow at the nozzle when necessary.

## 6. Automatic Sprinkler Systems

NFPA 13 contains the information necessary to design and install either type of system. The tables give minimum water supplies, densities, and pipe sizes for all types of occupancies.

The project engineer/designer checks with a reputable fire protection engineering consultant or sprinkler design company when evaluating existing systems or designing a new installation. Pipe material is selected based on the type of installation and the acceptability of the material to local fire and building officials where such systems may serve more than one purpose.

The employer ensures that all dry sprinkler pipes and fittings are installed so that the system may be totally drained.

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## 6.1 Water Supplies

Every automatic sprinkler system must be provided with at least one automatic water supply capable of providing design water flow for at least 30 minutes. An auxiliary water supply or equivalent protection provided when the automatic water supply is out of service (except for systems of 20 or fewer sprinklers).

If the water supply satisfies the combined design demand for sprinklers and standpipes, the employer may attach hose connections for firefighting use to wet pipe sprinkler systems.

Management ensures that automatic sprinkler system piping is protected against freezing and exterior surface corrosion by its material of construction (e.g., stainless steel) or by a protective coating (e.g., paint).

## 6.2 Sprinklers

Management ensures that sprinklers are protected from mechanical damage.

All sprinkler systems having more than 20 sprinklers must be equipped with a local water flow alarm that sounds an audible signal on the premises when the water flow through the system equals the flow from a single sprinkler.

Sprinklers must be spaced to provide a maximum protection area per sprinkler, a minimum of interference to the discharge pattern by building or structural members or building contents, and suitable sensitivity to possible fire hazards. The minimum vertical clearance between sprinklers and material must be less than 18 inches (45.7 cm).

Hydraulically designed automatic sprinkler systems (or portions thereof) are identified and the location and number of sprinklers in the hydraulically designed section and the basis of the design is indicated. Central records may be used in lieu of signs at sprinkler valves if the records are available for inspection.

## 7. Fixed Extinguishing Systems

### 7.1 General

The supervisor must warn employees who work around fixed extinguishing systems of the possible hazards associated with the system and its agent. For example, fixed dry chemical extinguishing systems may generate a large enough cloud of dry chemical particles that employees may become visually disoriented. Certain gaseous agents can expose employees to hazardous by-products of combustion when the agent comes into contact with hot metal or other hot surfaces. Some gaseous agents may be present in hazardous concentrations when the system has totally discharged because an extra-rich concentration is necessary to extinguish deep-seated fires. Certain local application systems may be designed to discharge onto the flaming surface of a liquid, and the liquid could splatter when hit with the discharging agent.

Because of the known toxicological effects of agents such as carbon tetrachloride and chlorobromomethane, use of these agents is not permitted in areas where employees could be exposed to the agent or its side effects. However, chlorobromomethane is acceptable and may be used as an explosion suppression agent in unoccupied spaces where employees will not be exposed.

A distinctive alarm signal is required to indicate that a fixed system is discharging on those systems where it is not immediately apparent that the system is discharging.

In some cases, (i.e., for mechanical or other reasons), a manual backup activation device is required. Although the location of this device is not specified, management should assume that the device will be located where employees can easily reach it. For example, the device could be located along the main means of egress from the protected area so that employees could activate the system as they evacuate the work area.

The site provides the PPE necessary to rescue employees who may be trapped in a totally flooded environment that could be hazardous to their health. This equipment would normally include a positive-pressure Self-Contained Breathing Apparatus (SCBA) and any necessary first aid equipment.

### 7.2 Dry Chemical Extinguishing Systems

Management verifies that dry chemical agents are compatible with any foams or wetting agents with which they are used.



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Dry chemical extinguishing agents of different compositions cannot be mixed. Management ensures that dry chemical systems are refilled with the chemical stated on the approval nameplate or an equivalent compatible material.

If a dry chemical discharge could obscure vision, the site/designer must install a pre-discharge employee alarm to give employees time to exit safely from the discharge area before the system discharges.

The employer samples the dry chemical supply of all but stored pressure systems at least annually to ensure that the dry chemical supply is free of moisture that could cause the supply to cake or form lumps. An easy test for acceptable moisture content is to take a lump of dry chemical from the container and drop it from a height of 10 cm. If the lump crumbles into fine particles, the agent is acceptable.

Management verifies that the dry chemicals are applied at a rate to allow the designed concentration of the system to be reached within 30 seconds of initial discharge.

### 7.3 Gaseous Agent Extinguishing Systems

Total flooding gaseous systems are based on the volume of gas that must be discharged in order to produce a certain designed concentration of gas in an enclosed area. The concentration needed to extinguish a fire depends on several factors, including the type of fire hazard and the amount of gas expected to leak away from the area during discharge. At times it is necessary to “super-saturate” a work area to provide for expected leakage from the enclosed area. In such cases, management must ensure that the flooded area has been ventilated, in accordance with [LUS-HSE-WG3-446-037](#), Ventilation, before employees are permitted to reenter the work area without protective clothing and respirators.

Certain halogenated hydrocarbons break down or decompose when they are combined with high temperatures found in the fire environment. The products of the decomposition can include toxic elements or compounds. For example, when Halon 1211 comes into contact with hot metal, it breaks down and forms bromide or fluoride fumes. In accordance with [LUS-HSE-WG3-446-009](#), Exposure Identification & Controls, management must investigate which toxic products could result from decomposition of a particular agent from the manufacturer and take the necessary precautions to prevent employee exposure to the hazard.

### 7.4 Water Spray and Foam Extinguishing Systems

When selecting the type of foam for a specific hazard, the project engineer/designer must consider the following limitations of foams:

- Some foams are not acceptable for use on fires involving flammable gases and liquefied gases with boiling points below ambient workplace temperatures. Other foams are not effective when used on fires involving polar solvent liquids.
- Any agent using water as part of the mixture cannot be used on fire involving combustible metals unless it is applied under proper conditions to reduce the temperature of burning metal below the ignition temperature. Management will use only those foams that have been tested and accepted for this application by a recognized independent testing laboratory.
- Certain types of foams could be incompatible and could break down when they are mixed together.
- For fires involving water-miscible solvents, use only those foams tested and approved for such use. Regular protein foams may not be effective on such solvents.
- When a foam or water spray system is used at a site, drainage facilities must be provided to carry contaminated water or foam overflow away from the employee work areas and egress routes. This drainage system drains to a central impounding area where it can be collected and disposed of properly. Other government agencies may have regulations concerning environmental considerations.

## 8. Fire Detection Systems

Fire detection systems, including custom fire detection systems, must be designed by knowledgeable fire protection or electrical engineers who are familiar with the workplace hazards and conditions. The manufacturer’s

recommendations for system design must be consulted. Some systems may only have one or two individual detectors for a small workplace, but good design and installation is still important.

When the systems are installed, an acceptance test will be performed on the system to ensure that it operates properly. Although entire systems might not be approved, each component used in the system must be approved.

Lusail requires that spare components used to replace those that might be destroyed during an alarm situation be available in sufficient quantities and locations for prompt restoration of the system. This does not mean that the parts or components must be stored at the workplace; if the employer can ensure that the supply of parts is available in the local community or the general metropolitan area of the workplace, then the requirements for storage and availability have been met.

Fire detection systems are supervised to ensure that the system's circuits are operational. Electrically operated sensors for air pressure, fluid pressure, or electrical circuits, can provide effective monitoring and are the typical types of supervision.

Fire detectors must be protected from corrosion either by protective coatings, by being manufactured of noncorrosive materials, or by location. Detectors must also be protected from mechanical impact damage, either by suitable cages or metal guards where such hazards are present, or by locating them above or out of contact with materials or equipment that may cause damage.

Information on the number, location, and spacing of detectors can be obtained from the approval listing for detectors, from NFPA standards, or from fire protection engineers or consultants or manufacturers of equipment who have access to approval listings and design methods.

## 9. Inspection

The competent person must inspect portable fire extinguishers and respirators at least monthly. Inspections must be documented. The Lusail HSE or Contractor HSE Representative is responsible for the inspection, maintenance, and testing of portable fire extinguishers. The actual inspection, maintenance, and testing may be conducted by outside contractors.

When an extinguisher has been removed from service to be checked or repaired, alternate equivalent protection must be provided. Alternate equivalent protection could include replacing the extinguisher with one or more units having equivalent or equal ratings, posting a fire watch, restricting the unprotected area from employee exposure, or providing a hose system ready to operate.

Before new sprinkler systems are placed into service, an acceptance test must be conducted. Management contacts the installer, designer, and a Qatar Civil Defense representative to witness the test. Management (or the owner) must correct any problems found during the test before the system is placed in service. Proper acceptance tests include the following tasks:

- Flushing of underground connections
- Hydrostatic tests of piping in system
- Air tests in dry-pipe systems
- Dry-pipe valve operation
- Test of drainage facilities

Firms providing hydrostatic testing must be certified by the Qatar Government, or their designee.

## 10. Maintenance

Sprinkler system maintenance is performed only when there is minimal employee exposure to the fire hazard. For example, if the system is to be repaired or changed, this work must be performed during hours when employees are not working or are not occupying that portion of the site protected by the portion of the system that has been shut down.

The authorized management representative conducts a main drain flow test on each system annually. The inspector's test valve must be opened at least every two (2) years to ensure that the sprinkler system operates properly.

The procedures for performing a flow test via a main drain test or by the use of an inspector's test valve can be obtained from NFPA 13A or the Civil Defence Fire Safety Handbook.

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Management is responsible for maintaining all fixed extinguishing systems, but this responsibility does not preclude the use of outside contractors to do such work. New systems are subject to an acceptance test before placed in service. Problems found during the test must be corrected before the system is considered operational.

## 11. Training

All Contractors must ensure that employees are provided with adequate safety training that includes suitable and sufficient instruction and training on the appropriate precautions and actions to be taken by employees in order to safeguard themselves and other relevant persons on the premises. The training must consider the fire risk assessment and all emergency response procedures in accordance with [LUS-HSE-WG3-446-011](#), Emergency Planning & Response. The training should cover:

- a) discovering a fire
- b) how to raise the alarm
- c) what to do on hearing the alarm
- d) procedure for alerting visitors and all staff
- e) calling the fire service
- f) evacuation procedures, assembly points and fire drills
- g) location and use of fire-fighting equipment
- h) location of escape routes
- i) how to open escape doors
- j) importance of fire doors
- k) how to stop equipment and isolate power
- l) not using lifts
- m) use and risks of highly flammable and explosive substances
- n) good housekeeping
- o) smoking policy and smoking areas

The Contractor arranges initial employee training, which may be presented to groups or on a work area by work area basis, depending on the operation.

Supervisors address and communicate appropriate safe behavior and controls at daily huddles before beginning work.

## 12. Documentation

The records custodian documents all instruction and training. The HSE Representative maintains project records at the site for the duration of the project and archives them for a minimum retention time of 10 years from creation date.

## 13. References

Qatar Ministry of Interior, Civil Defence Dept., Fire Safety Handbook

Qatar Construction Specifications 2010 Section 11 Part 1.7 “Fire and Flammable Substances”

Qatar Construction Specifications 2010 Section 11 Part 2.3.13 “Fire Precautions During Construction Works in Buildings”

Qatar Construction Specifications 2010 Section 1 Part 10.5 “Fire Precaution and Prevention”

EM 385-1-1, Safety – Safety and Health Requirements, Section 9, Fire Protection and Prevention; Section 10.C, Welding and Cutting Fire Protection; and Section 26.D, Underground Construction (tunnels), Shafts, and Caissons, Fire Protection and Prevention

NFPA 1971–1975, Protective Clothing for Structural Fire Fighters

NFPA 10, Portable Fire Extinguishers

NFPA 13, Automatic Sprinkler Systems

NFPA 13A, Sprinkler System, Maintenance

NFPA 14, Standpipe and Hose Systems