



 XL Insurance

Fire: Environmental exposures and risk management

An environmental
white paper



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Overview

A catastrophic structure fire is a peril of great concern to any risk manager. In addition to the potential for loss of life, it often results in a stress test of the effectiveness of an entire enterprise risk management program. Business interruption impacts can be severe even when business continuity and disaster recovery plans are implemented. Multiple insurance claims may need to be resolved and insurance providers may need time to sort them out.

Every business has some form of environmental exposure and a fire just increases the potential for incurring environmental liabilities. A fire or explosion can trigger claims for environmental remediation, bodily injury, property damage, and business interruption both on- and off-site under a pollution liability insurance policy. Legal costs can also quickly escalate when third party claims are involved or when disputes arise over responsibility/liability. Large industrial fires also have the potential to cause natural resource damages that can result in additional fines and penalties.

A structure fire involving hazardous materials or waste has the potential to result in toxic air emissions and contamination of soil, groundwater, and surface water. Manufacturing sites and other high-risk occupancies present obvious fire concerns due to the chemicals and processes utilized. However, so do other operations and occupancies that may be perceived to have a lower exposure. For example, a plastic product manufacturing firm may not utilize any significant quantities of hazardous materials, but a catastrophic fire can create toxic combustion by-products such as dioxins and furans. Even a routine office building fire can have environmental impacts from the combustion of furnishings, plastics, electronics, and janitorial supplies.

This paper provides an overview of recent high-profile fire impacts, fire types and sources, environmental impacts, and risk identification and mitigation techniques. It concludes with examples of real claim scenarios involving fires that resulted in a variety of environmental impacts. As a part of any sound risk management program, risk managers should consider obtaining a pollution liability insurance policy to help their business overcome fire incidents and associated environmental impacts.

What a year!

Perhaps the most well-known recent structure fire resulting in environmental impacts occurred in April 2019 at the world-famous Notre-Dame Cathedral in Paris. The fire burned not only the 856-year old structure, but also approximately 460 tons of lead in the roof and spire (which equates to about four times the lead emissions in all of France for a year).

As a result, toxic lead particles were released into the air and onto the ground and structures in the area. In addition, fire-fighting water used to extinguish the blaze resulted in a release of contaminants to stormwater and surface water. After significant government sampling and testing, the area around the cathedral was sealed off in August 2019 to remove hazardous dust that had settled on homes, schools, businesses, and the ground in the surrounding area.

In the United States the spring and summer of 2019 alone were filled with multiple high-profile fires that resulted in environmental impacts including:

Intercontinental Terminals: March 2019 fire at their chemical storage facility in Deer Park, Texas resulted in a large plume of black smoke and release of thousands of barrels of chemicals into local waterways. The incident triggered shelter-in-place warnings and school closings due to elevated levels of benzene in the air; and resulted in a partial shutdown of the Houston Ship Channel due to a petrochemical plume.

KMCO Chemical: April 2019 explosion and fire at their plant in Crosby, Texas resulted in a fatality and critical injuries. A large plume of smoke triggered a shelter-in-place warning for those within a 1-mile radius of the plant. Regulators subsequently assessed \$80,000 in fines for an alleged pattern of past violations of environmental laws (air pollution) at the facility.

Philadelphia Energy Solutions: Two fires in June 2019 at their oil refinery complex in South Philadelphia, Pennsylvania resulted in shelter-in-place orders and temporary closure of the Platt Bridge, a major artery into southwest Philadelphia. While fence line air monitoring showed no immediate danger and the shelter-in-place orders and temporary closures of the bridge were lifted after several hours, the two successive fires ended operations at the refinery with a bankruptcy declaration in July 2019. It is also speculated this closure will likely lead to the discovery of pre-existing/new pollution conditions at the 1300-acre facility that had been in operation since the 1870s.

Exxon Mobil: July 2019 fire at Exxon's Olefins Plant in Baytown, Texas resulted in a release of a large plume of dark black smoke into the area. The fire was quickly contained but resulted in a shelter-in-place order and local area business interruption. Harris County subsequently filed a lawsuit against Exxon for "unauthorized emissions to the atmosphere" consisting of multiple air pollutants including benzene, propylene, propane, and associated products of combustion. They are also seeking a temporary and permanent restraining order to prevent future fires and for Exxon to abide by the Texas Clean Air Act.

Jim Beam: July 2019 lightning strike and fire at a storage warehouse in Woodford County, Kentucky that held 45000 barrels (i.e., 2.385 MG) of aging whiskey resulted in a total loss. Officials elected to let the fire burn to reduce the flow of alcohol runoff into nearby waters; however, an unknown amount still entered Glenss Creek and the Kentucky River and ultimately resulted in a fish kill and estimated 23-mile-long plume that reached the confluence with the Ohio River. Environmental violations and penalties are anticipated.



Fire environmental impacts

Contaminants of concern

Building contents and the nature of site operations have a significant influence on the potential environmental impacts from a fire. A warehouse filled with pesticides or an electroplating manufacturer have far greater exposures than an operation that does not store chemicals or generate hazardous waste. However, even a fire at a certified “green” building can cause environmental impacts. Modern buildings contain greater amounts of synthetic plastic and textile materials, which are both more flammable and toxic than natural materials.

There are a large variety of hazardous substances that can be released during a fire. These substances may include contaminants such as: general pollutants/indicators, metals, particulates, polycyclic aromatic hydrocarbons (PAHs), chlorinated dioxins and furans, brominated dioxins and furans, polychlorinated biphenyls (PCBs) and polyfluorinated compounds.

A fire can result in inhalation, absorption, and skin/mucous membrane irritation hazards from airborne vapors, fumes, and particulates as well as from surface area deposition on soils, buildings, vehicles, etc. Contaminants can also be introduced into the environment from foams and other fire retardants used to extinguish the fire.

Short- and long-term environmental impacts

There are usually short- and long-term environmental impacts from a structure fire. The short-term impacts are experienced by the affected community immediately following the fire event. Long term effects are often less obvious, and the affected neighboring communities may not be aware or suspect impacts for some period after the fire.

Short term fire effects include the impact to the local environment within the fire smoke plume zone and the water runoff zone. The short-term effects are typically concentrated in the local area/vicinity of the fire and immediate surrounding areas. These may be easier to mitigate and prevent from escalating relative to unaddressed contamination that can result in longer term impacts requiring more expensive remedies. Impact assessment studies are typically required to identify both short term and potential longer-term consequences.

Long term fire effects include impacts that are not immediately felt or recognized. These effects are more likely to impact the surface water/sediments, groundwater, and soils around the fire site. The list of hazards that result from long term effects can be extensive, but contaminant air deposition and contaminated soils can serve as a long-term source of stormwater, surface water, and groundwater contamination.

Air emissions

The smoke plume created from the fire is the largest contributor to potential air contamination. Emissions typically include inorganic gases, volatile organic compounds (VOCs), PAHs, and dioxins. Note that dioxin emissions from a fire are estimated to be similar to those emitted from urban traffic or municipal waste combustion. Short term health hazards can also be caused by

Fire types and root causes

Fire root causes and sources are highly variable, but generally incidents can be categorized as one of three general types: structure fires, vehicle fires, or outside fires.

- Structure fire sources are typically traced to faulty electrical equipment or building systems, hot work operations, hazardous materials, natural sources, or intentional arson.
- Vehicles with petroleum fluid leaks or faulty electrical systems are a common cause of structure fires in garages, car maintenance, and storage facilities.

- Outside fire sources can involve lightning, smoking, campfires, uncontrolled brush burning, and other ignition sources. In the US, outside and unclassified fires comprise 75% of intentionally set incidents. Outside sources can result in larger wildfires that can sometimes imperil structures miles away.

In manufacturing settings, fires and explosions can result from chemical reactions; process equipment and pressure vessel failures; heated chemicals, tars and oils; combustible dust; spilled chemicals; and volatile vapors. Fires involving hazardous materials often result in serious building destruction and damage to surrounding areas. Hot work involving welding or cutting torches, soldering, burners, heat treating equipment, and power equipment continues to be a leading cause of structure fires at manufacturing facilities and other types of occupancies.

Surface run-off resulting from large quantities of fire-fighting water can contain PAHs, VOCs, hydrocarbons, dioxins, metals, ammonia, and other suspended solids... Contaminated fire-fighting effluent should be contained onsite if possible and treated prior to the water entering and disrupting wastewater treatment plants or impacting wetlands and nearby water ways.

nitrogen oxides, sulfur oxides, some metals, halogenated acids (HX), and particulates. The average general population is not likely to be harmed by fire air emissions, but they can be quite dangerous for the at-risk population (e.g., children, elderly, immune-compromised).

Surface water & stormwater impacts

Firefighters and automatic sprinklers use water and other extinguishing agents to both extinguish and prevent the fire from spreading. Surface run-off resulting from large quantities of fire-fighting water can contain PAHs, VOCs, hydrocarbons, dioxins, metals, ammonia, and other suspended solids. In addition to these by-products, hazardous raw materials impacted by the fire will also be present in the fire effluent. Contaminated fire-fighting effluent should be contained onsite if possible and treated prior to the water entering and disrupting wastewater treatment plants or impacting wetlands and nearby water ways.

Soil and groundwater impacts

Effects on surface soils and groundwater can manifest long after the fire is extinguished and serve as a threat to local air quality and water supplies. Ash, dust, and airborne soil contamination can provide an on-going inhalation exposure pathway for local residents and businesses.

Hazardous materials not consumed by the heat of the fire can remain in soils and migrate to groundwater. In addition to the potential exposure to the chemical products present in the structure prior to the fire, there can be long-term health impacts from soils containing combustion by-products such as PAHs, dioxins, furans, and metals.

Fire contaminants can serve as an on-going groundwater contamination source. Contaminant plumes may not manifest until years later when impacts to a water supply well or another sensitive receptor are discovered.

Fire prevention best practices

Compliance and industry standards

Strict adherence to Federal, State, and local fire codes should be an essential compliance and risk management component of any fire prevention program. Also, utilizing the fire prevention best practices outlined by industry organizations such as the National Fire Protection Association (NFPA) is highly recommended. Some of these guidelines have even been referenced and codified in various regulations. Comprehensive preventative maintenance and facility housekeeping programs are also essential proactive measures.

Implementing a robust environmental health and safety compliance program and a routine building and grounds inspection program are good fire prevention steps. Several of the above facilities with high profile fire incidents in mid-2019, also had a history of Federal and State environmental and safety violations. Fines, penalties, and violations may not be direct indicators of the adequacy of fire prevention and safety programs; however, sites with a history of hazardous material releases, process safety violations, and other operational issues can portend greater risk. In general, improved environmental and safety programs can translate to better general liability, pollution liability, workers compensation, and property fire risks.

Identify exposures

During a fire, the environmental impact from carbon being pumped into the environment unabated is evident from the smoke plumes that can be seen for miles; however, it is the environmental exposures post-fire that might not be so evident and result in short and long-term liabilities.

Catastrophic fires can cause pollution conditions, including natural resource damages, which result in costly environmental remediation projects. The consequences of a fire can also include pollution related bodily injury and property damage claims from nearby property owners resulting in legal defense expenses in the wake of a disaster. The negative public relations associated with environmental impacts and legal battles can also take a toll.

Environmental exposures during/after a fire may include the following:

- Air Emissions/soot (polycyclic aromatic hydrocarbons, lead, etc.) impacts to the surrounding area and cleaning of exposed property (land, structures, cars, etc.)
- Contaminated runoff water discharged to soil, groundwater, wetlands, surface water, sewer, etc. (i.e., fire-fighting water as well as onsite fire suppression systems)
- Fire department evacuation or shelter-in-place orders due to hazardous air emissions
- Environmental remediation and disposal of fire debris
- Discovery of pre-existing and new pollution conditions during efforts to restore site operations

Business interruption exposures can include fire-related complications such as the following:

- Evacuation and/or loss of use of the property and/or surrounding properties including relocation expenses
- Transportation corridor closures/interruption
- Water damage and smoke damage restoration in portions of fire-damaged buildings or nearby buildings
- Need for site investigation and/or remediation prior to resuming operations
- Increased regulatory scrutiny and/or need to obtain permits to reoccupy the site

Identify mitigating factors

New tools are being developed to evaluate the potential environmental impact and fire “footprint” of a specific building and/or operation. Fire protection designers can use this information to incorporate sustainability concepts, fire prevention, and fire protection measures that will decrease environmental impacts should a fire occur. These assessments can also be used to better understand the contribution first responders and fire services can have on environmental impacts.

Fire services are primarily concerned with life safety and minimizing bodily injury and property damage to the surrounding community. Although hazardous air emissions downwind of the fire area may be an obvious concern, contaminated firefighting water and environmental impacts may be an afterthought. Property owners should ensure that fire services and other first responders understand the hazardous materials and other building risk factors that are present before responding to an incident. Fire prevention inspections with a local fire marshal or fire department will help raise awareness and identify mitigating factors that can be employed during an emergency response.

Emergency planning and controls

What steps can be taken to minimize worst case environmental scenarios from a fire?
Pre-emergency planning is essential.

Property owners should, in advance of any incident, disclose to local public fire service personnel any significant chemicals or operations that could exacerbate fire conditions or create environmental concerns. This includes annual submission of an Emergency Planning and Community Right-to-Know Act (EPCRA) Emergency and Hazardous Chemical Inventory Form (Tier II Forms) to fire departments. First responders need to be aware of the type of hazardous materials that may be encountered at a site and whether the use of water, foam, or other fire suppressants is appropriate.

Knowledge of the fire suppression systems present at a property is important so that first responders understand what is expected of them when responding to a fire. Building sprinkler systems often make the job of extinguishing a fire easier for fire services. Although sprinklers typically use much less water to control a fire than manual fire suppression when no sprinklers are present, the sprinkler runoff water must still be managed. Inspection and testing of fire suppression systems should follow manufacturer/installer recommendations and regulatory agency requirements.

On-site fire brigades are typically only present at high hazard occupancies and industrial facilities. These individuals and organizations are subject to additional compliance and training requirements. Use of foam and other fire retardants, specialized fire suppression equipment, and personal protective equipment

requires in-depth knowledge, training, and certification. Fire brigades may also need to have OSHA-mandated Hazardous Waste Operations and Emergency Response (HAZWOPER) training for responding to hazardous chemical fires and spills.

In some areas, the public fire services are taking the additional step of covering and blocking storm water drains to manage firefighting water and foam runoff because they are prepared and adequately equipped to do so. Engineered controls can be incorporated into site plans to more effectively manage runoff so that soil and water contamination is prevented altogether or greatly limited. Stormwater retention ponds can be designed to contain contaminated runoff and prevent discharge to storm sewers or surface waters. Alternatively, parking lots with concrete curbs and strategically placed drains can serve as a large secondary containment area for contaminated sprinkler or firefighting water. Such impoundment areas can give first responders a fighting chance to contain and subsequently pump contaminated water into tanks or vacuum trucks for off-site disposal before widespread soil, groundwater, and surface water contamination results.

Fire services that do not have a strong working relationship with business and industry in their communities or those that have not considered the aforementioned controls can exacerbate fire-related environmental impacts. While fire services and first responder objectives are primarily to protect life and property, with a little cooperative planning with the property owner, environmental impacts can also be minimized while they fulfill their duties.

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Fire and pollution liability claim examples

The following scenarios are taken from actual claims submitted to, and actively managed by AXA XL's claims team.

Explosion during railcar unloading activities

A chemical manufacturer experienced an explosion while unloading chemicals from a train car at the facility. Although the fire suppression waters flowed beyond the plant and into storm drains up to a mile away, limited contaminants impacted surface waters and only limited pollution impacts occurred beyond the building perimeters. Total remediation costs exceeded \$550,000.

Tank farm causes extensive remedial action

A tank farm fire at a Kansas chemical manufacturing facility occurred when a static discharge occurred while employees of the insured and an employee of a common carrier were loading mineral spirits into a tank. All 39 aboveground tanks, which contained a total of 650,000 gallons of various hydrocarbon solvents, caught fire. Over 4,000 people were evacuated over a two-mile radius. The facility experienced an almost complete loss of the site. In addition to emergency response objectives, methods to contain the firefighting fluids from entering the nearby Arkansas River and evaluations of air monitoring were paramount. Environmental remediation efforts exceeded \$3.75 million.

Fire at a fertilizer warehouse results in environmental insurance payments

A fire at an agricultural chemical warehouse containing dry fertilizer and herbicides resulted in the evacuation of several hundred homes and businesses. A total of \$1.1 million was paid in claims associated with business interruption, residential property damage, bodily injuries, environmental remediation and municipal claims.

Chemical reaction results in pesticide release

A chemical reaction occurred within several drums of methyl parathion, a toxic substance used in insecticides, at a pesticide manufacturing facility in Texas. The reaction caused the substance to overheat. The drums were placed outdoors and the local fire department was notified and sprayed the drums with water that did not stop the reaction. The facility was evacuated prior to the failure of the drums, which released a plume of methyl parathion. Additional evacuations occurred in the surrounding area. Emergency clean-up was needed to address the run-off of fire suppression water and neutralize impacted soils. Remedial efforts totaled \$350,000.

Reactor explosion causes damage to containment system

Two reactors at a chemical facility exploded due to emergency shut-down system software failure. The reactors were used to split cumene hydroperoxide into phenol and acetone. Area residents were urged to stay indoors until the fire and smoke dissipated. Due to the explosion, the containment area around one of the reactors was breached. Released materials traveled through the storm water collection system and discharged into an earthen containment pond used for sediment control prior to discharge into a "local canal". It took approximately three days to complete shutting off the flow of stormwater from the pond into the canal. In addition to releases of cumene, phenol, acetone, and cumene hydroperoxide, over \$4 million in property damage occurred. The facility entered into a voluntary remedial program involving natural attenuation and monitoring. The insured alleged over \$60 million in business interruption costs. The remedial/pollution liability portion of the claim totaled almost \$700,000.

Conclusion

Every business has some form of environmental exposure and a fire incident can greatly increase pollution liabilities, particularly those at industrial facilities, but even at relatively benign sites like a finished product warehouse or office building. Fires can and do result in environmental impacts from the contents of the building as well as the methods used to extinguish the fire. A structure fire can destroy more than property. It has the potential to destroy the viability of an enterprise, particularly if there are short- and long-term environmental impacts.

To manage these exposures, businesses need to proactively incorporate both institutional and engineering controls into their day-to-day operations. This includes identifying risks and mitigating factors, strengthening fire prevention and general environmental, health and safety compliance, completing emergency planning, and conducting training and drills with first responders.

As a component of a sound risk management program, AXA XL can provide pollution insurance policies that can assist a variety of residential, commercial, and industrial business owners. AXA XL offers a Pollution and Remediation Legal Liability policy that can provide coverage for fixed real estate assets subject to environmental impacts caused by fire.

Further AXA XL offers Contractors Pollution Liability coverage to construction firm, subcontractors, and environmental service providers that may become involved in fire claims with related pollution liability.

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