

**I AVIVA** 

Fire events impact organisations in many ways, including damage to property, business interruption losses but also potentially contamination of the premises and other facilities or features in proximity. This can lead to prolonged delays and significant cleaning costs.

This Loss Prevention Standard examines contamination hazards, their impact and the steps you can take to minimise their impact during a fire

Version: 1.5 Date: 31<sup>st</sup> May 2025

**NIVA I** 

# Contamination Following a Fire - Property

#### Introduction

Contaminants released during a fire can create significant challenges for firefighters, building owners, occupants, and businesses. These contaminants require careful handling and containment during a fire event, and often necessitate extensive clean-up and decontamination before operations can be resumed. These delays can increase financial losses, prolong business interruption, as well as creating health and environmental exposures.

Recent research has identified a growing range of

contamination hazards, including emerging threats such as Per- and Polyfluoroalkyl Substances (PFAS), microplastics, and toxic chemical byproducts. These contaminants can persist long after a fire is extinguished, damaging property, and causing health and environmental harm.

The complexity of these hazards underscores the importance of comprehensive planning, risk assessment and risk management, all of which can help reduce the extent of damage but also improve the likelihood and speed of a successful business recovery. This Loss Prevention Standard examines contamination hazards (both well-known and emerging), their impacts, and the practical steps businesses can take to minimise their effects during and after a fire.

**Note:** This document is focussed on Property loss prevention in relation to fire related contamination. It is not intended to address liability exposures. The presumption is that all regulatory requirements, Fire Risk Assessments, and compliance with requirements placed by the local authority having jurisdiction, which would include licencing, building permissions, regulations, codes, or standards, have or will be met.

# **Contamination Hazards**

Fire contamination hazards come in many forms, ranging from well-known risks to emerging threats identified through recent research. Understanding these hazards is crucial for effective property risk management following fire events. The following section outlines key contamination hazards and potential impacts:

**Smoke, soot and acid gases**. These agents are produced in most fires and can spread throughout buildings, depositing toxic residues on surfaces, causing immediate and long-term property damage, as well as posing dangers to occupants and firefighters.

**Chemicals**. A range of chemicals are present in workplaces that can vaporise during fires, becoming entrained in smoke plumes. Plumes containing corrosive substances e.g., hydrochloric, sulphuric and nitric acids used in industrial processes and products can disperse widely, causing extensive damage to property, whilst toxic chemicals present an immediate threat to firefighters and other persons in proximity.

Some chemicals decompose under heat and/or via the application of firefighting water, potentially releasing more hazardous substances or even leading to explosive reactions.





Chemical contaminants entrained within the smoke plume or within damaged containers or machinery can also dissolve within the firefighting water, leading to contaminated fire-water runoff, which can spread across walls, ceilings and floor surfaces, and enter drains or watercourses. Contamination can also persist long after a fire is extinguished, potentially recontaminating water supplies.

Per- and Polyfluoroalkyl Substances (PFAs) commonly found in firefighting foam are persistent chemicals that can contaminate soil and water sources.

**Asbestos**. Asbestos has been banned from use in the UK since 1999, however, remains present in many properties constructed before this date, and is commonly used as a fireproofing and insulating material in various building components, including flooring, walling, pipework, ceilings, boilers etc.

During a fire, Asbestos-Containing Materials (ACMs) can become damaged, releasing hazardous fibres into the air, which can be entrained within smoke plumes, spread over a wide area and settle unnoticed both within and external to the building, presenting health concerns. The presence of asbestos can cause delays in firefighting and necessitates specialist decontamination following a fire, along with the removal of any fire-affected materials. This can significantly increase the potential for significant fire losses, as well as extended reinstatement periods and costs.

**Burning Plastics**. Plastic materials typically produce high heat output, accelerating fire spread and increasing radiant heat damage. Their thermal decomposition can generate the release of various chemical substances, many of which are highly corrosive and toxic. Smoke plumes can transport these hazardous agents to other areas, potentially incurring further damage and cleaning costs.

**Oils and lubricants**. These materials are typically used in process machinery or held in storage and can support fire growth and contaminate soil and drainage systems if released during a fire. Whilst some may burn or decompose, many higher oil fraction derivatives persist, potentially leading to environmental contamination.

**Lead dust.** Heat from fire events can cause lead, typically present in roofing materials and old pipework, to release harmful fumes, which can condense into toxic dust. Contaminated buildings will require extensive cleaning, and in extreme cases, partial or full demolition and reinstatement.

**Lithium-ion Batteries**. Gases released during a fire event involving lithium-ion batteries can include hydrogen fluoride and hydrogen chloride, both of which are corrosive as well as toxic. Prolonged application of firefighting water can result in significant volumes of contaminated water to contain and remove, often at substantial cost.

# **Understanding the Risks**

Fire contamination poses numerous risks that extend beyond the immediate fire damage. By considering these risks fully, organisations can develop more comprehensive strategies for preventing, mitigating, and responding to fire-related contamination incidents:

#### **Property Damage**

Buildings that appear to have escaped physical damage in a fire may have incurred significant contamination to surfaces such as walls, floors, insulation and ceilings.

Contamination from fire incidents can also render equipment, fittings and stock unusable, even if not directly damaged by flames. Even trace amounts of contaminants can lead to product recalls, regulatory non-compliance, or failure to meet quality standards. The financial impact can be substantial, often exceeding the value of fire-damaged items.

Additionally, the loss of stock can lead to production delays, missed orders, and potential loss of market share.

Sensitive equipment, manufacturing areas, clean rooms etc., are particularly vulnerable and seemingly minor levels of contamination can render such facilities unusable or requiring extensive decontamination. The costs associated with cleaning or replacing sensitive equipment can be substantial.

IAVIVA

#### Corrosion

A number of corrosive substances can be released during a fire event, which pose significant risks to building materials, machinery, and equipment. The corrosive effects can manifest rapidly and continue long after the fire is extinguished, particularly in areas with high humidity or residual moisture.

Metal components and structures are particularly vulnerable to corrosive attack. This can lead to weakening of structural elements, compromising the integrity of buildings and equipment. The corrosion process can be accelerated in the presence of moisture, potentially causing long-term stability issues if not addressed promptly.

Electrical systems and circuitry are also at high risk. Corrosive substances can damage insulation, cause short circuits, and lead to the failure of sensitive electronic components. This damage may not be immediately apparent and can result in equipment malfunctions or electrical hazards long after the initial incident.

Plastics and polymers used in various applications can suffer from softening or embrittlement when exposed to corrosive substances and heat, affecting the performance and lifespan of affected components, potentially leading to unexpected failures or increased maintenance requirements.

#### Salvage

Contamination can render otherwise salvageable items unusable. The presence of toxic substances may require specialised cleaning procedures or make decontamination economically unfeasible. This can significantly increase the overall loss and prolong the recovery process.

#### **Specialist Decontamination**

Many contamination scenarios require specialist decontamination services, which can be costly and time-consuming. This is particularly true for asbestos contamination, chemical spills, or widespread soot deposition. The need for specialist services can delay other aspects of the recovery process and increase overall downtime.

# Drainage

Contaminated fire water runoff can damage or overwhelm drainage systems and sewers, potentially leading to foul water ingress to other buildings in proximity, environmental pollution and regulatory issues. The release of hazardous substances into water systems may require extensive remediation efforts and can result in significant fines or legal liabilities.

# **Neighbouring Properties**

Contamination spread from neighbouring properties can:

- Damage goods stored in the open.
- Be drawn into ventilation systems and affect internal areas and processes.
- Corrode external construction elements.

#### Firefighting

Where there is no risk to life and where contamination hazards are identified as posing a risk to firefighters, the Fire and Rescue Service may adopt a defensive fire-fighting stance as a precaution to safeguard firefighters. This can significantly increase the extent of property damage, the accompanying period of business interruption and the resultant financial impact of the fire.

#### **Prolonged Business Impact**

The cumulative effect of contamination-related issues can lead to extended periods of business interruption. Decontamination, equipment replacement, and regulatory compliance can significantly delay recovery efforts. In some cases, contamination may necessitate relocation or permanent closure of facilities, particularly in industries with stringent cleanliness requirements.

ΙΑΥΙΥΑ

#### **Risks to the Environment**

Fire contamination can have severe and long-lasting environmental impacts. Soil and water contamination from chemicals, heavy metals, and persistent organic pollutants can harm ecosystems and require extensive remediation efforts.

#### **Reputational Risks**

Contamination incidents can damage a company's reputation, particularly if they result in environmental damage or public health concerns. Effective crisis communication and transparent remediation efforts are crucial for maintaining stakeholder trust and minimising long-term reputational impacts.

# **Minimising Risk and Mitigating the Impact**

Adopting a structured approach to identifying contamination hazards and assessing the risks to your business is highly recommended, as is documenting a plan to minimise risks and mitigate any residual risks. The following step by step approach should be considered:

#### Step 1 – Risk Assessment

Conduct a comprehensive risk assessment that includes:

- Identification of potential contaminants, such as oils, chemicals etc., along with emerging threats such as PFAs and microplastics.
- Evaluation of the current storage and handling practices for hazardous/potentially hazardous materials, equipment etc.
- Assessment of building materials and their potential to release toxins during a fire.
- Assessment of the potential damage to property relating to such agents in the event of a fire including structural damage to loadbearing elements, damage to machinery and equipment, stock etc.
- Consideration of business interruption scenarios due to contamination.
- Analysis of potential environmental impacts, including soil, river, lake and other water contamination.

#### Step 2 – Prevention Measures

Implement preventive measures to reduce contamination risks:

- Proper storage and containment of hazardous materials and reducing the inventory of chemicals on site.
- Substitute hazardous substances with another substance that presents less / no risk.
- Fixed Fire Protection Systems providing prompt suppression of fire can help prevent fire growth and limit the scale of any contamination.
- Regular maintenance of fire suppression systems and investigate substitution of suppression agents with less hazardous materials.
- Installation of containment systems for chemical storage, lithium-ion batteries etc.
- Use of fire-resistant building materials where possible.
- Removal/replacement of building materials identified as presenting an increased contamination risk e.g., plastic based etc.
- Protection of loadbearing elements e.g., coatings etc.



- Reducing fire load by reduction in storage and use of combustible materials to help slow or limit fire growth and spread potential.
- Installation of smoke ventilation systems. The planned and intentional removal of smoke from a building can slow the rate of fire growth and spread.
- Isolation of air handling units in the event of fire alarm/detection system activation to avoid moving contaminants through the building.
- Implementation of strict housekeeping practices to minimise or segregate combustible materials both internally and externally.

# Step 3 – Emergency Response Planning

Develop a detailed emergency response plan that addresses contamination risks:

- Procedures for rapid containment of contaminants during a fire, including safety rules and procedures.
- Guidelines for safe evacuation considering potential contamination spread.
- Protocols for communication with emergency services about on-site hazards.
- Ventilation of the affected area to prevent further damage from smoke corrosion.
- Isolation of power or gas supplies or process machinery and how to check it has been safely isolated to permit safe removal from the affected area.
- How to remove or cover undamaged goods and equipment. Consider what equipment may be needed to safely remove items of equipment from the affected area.
- Plans for immediate post-fire assessment of contamination levels.
- Identification of special methods to deal with substances posing health or environmental risks.
- Procedures for recovering spilled product and safe handling and legal disposal of associated waste.
- Provision of appropriate personal protective equipment, including fitting and regular inspections/maintenance etc.
- Assess whether the application of a corrosion inhibitor would be beneficial for any surfaces or for items of equipment. On-site storage may be appropriate, particularly if quick application is needed, along with guidance on procuring further stocks.
- Deployment of firewater management/containment and removal in conjunction with the local Fire and Rescue Service.
- Clear definition of circumstances under which the plan should be activated.
- Security arrangements for the affected building to prevent unauthorised access e.g., looting etc.

# Step 4 – Containment Strategies

Develop strategies to contain contamination during and after a fire:

- Creation of fire resisting compartments for separating hazardous processing or storage areas.
- Installation of containment systems for firefighting runoff.
- Use of absorbent materials to prevent the spread of liquid contaminants.
- Procedures for sealing off affected areas to prevent cross-contamination.
- Protocols for managing contaminated debris and materials.
- Implementation of firewater containment facilities such as lagoons, tanks etc.
- Installation of shut-off valves and isolation tanks or areas.

# **Step 5 - Decontamination Procedures**

Establish comprehensive decontamination procedures:

- Identification of appropriate cleaning methods for different types of contaminants.
- Protocols for safe handling and disposal of contaminated materials.
- Procedures for decontaminating personnel and equipment.
- Guidelines for engaging specialised decontamination services when necessary.
- Development of a salvage plan to minimise damage from contamination or corrosion.

#### **Step 6 - Environmental Monitoring**

Implement ongoing environmental monitoring:

- Regular testing of soil and water for potential contaminants.
- Air quality monitoring in and around affected areas.
- Long-term tracking of potential environmental impacts.
- Compliance with regulatory requirements for environmental reporting.
- Assessment of impact on nearby properties and ecosystems.

#### Step 7 - Recovery and Business Continuity

Develop robust recovery and Business Continuity Plans (BCP):

- Procedures for assessing and mitigating business interruption due to contamination.
- Strategies for temporary relocation of operations if necessary.
- Plans for managing reputational risks associated with contamination incidents.
- Protocols for engaging with stakeholders, including customers and regulators, during recovery.

ΙΑΥΙΥΑ

• Development of a communication strategy for media inquiries and public information.

# Step 8 – Training and Awareness

Ensure all staff are trained and aware of contamination risks, including:

- Regular drills incorporating contamination scenarios.
- Education on the health risks associated with fire contaminants.
- The proper use of personal protective equipment (PPE).
- Awareness of the environmental impact of contamination and mitigation strategies.
- Fixed fire protection systems: operation, maintenance, and contamination risks.
- Fire compartmentation: importance and maintenance of integrity.
- Surface linings: selection of appropriate materials to minimise toxic emissions.
- Smoke ventilation: proper use and potential for spreading contaminants.
- Design of air handling units to avoid contaminant spread through heating, ventilation and air conditioning (HVAC) systems.
- Building services: protection and isolation procedures during fire incidents.
- Gas delivery systems: safe shutdown and containment of potential leaks.

# Step 9 - Continuous Improvement

Implement a system for continuous improvement:

- Regular review and update of risk assessments and mitigation strategies.
  - ✓ Have new contaminants been introduced into the building, e.g., new building materials, chemicals, other storage?
  - ✓ Have inventories of chemicals changed and if so, what is the impact of this?
  - ✓ Have any potential contaminants been removed?
  - ✓ Have any additional sensitive areas or items of equipment been introduced?
  - ✓ Have fire compartment boundaries been changed?
  - ✓ Are fire compartment boundaries intact?
  - ✓ Are fire protection systems, smoke venting systems and air handling units appropriately tested and maintained?
  - ✓ Are contractors and suppliers detailed in the BCP still operating and can they continue to commit to supply identified goods and services?
  - ✓ Are salvage plans still valid?
  - ✓ Have new building materials been introduced that require different methods of cleaning?
  - ✓ Have staff fulfilling core roles received suitable briefings and training?
- Ensure the BCP remain current and valid.
- Collate and ensure lessons are learned from incidents and near-misses.

- Staying informed about emerging contaminants and new mitigation technologies.
- Participate in industry forums and collaborate with research institutions to enhance knowledge and practices.

AVIVA

• Undertake periodic audits of contamination prevention and response procedures.

# **Key Actions**

The impacts of contamination occurring from a fire incident can be minimised through careful planning, comprehensive risk assessment, and prompt action during and following a fire event. With appropriate planning and procedures, organisations can significantly reduce the long-term impacts of fire related contamination to property, and ensure a more efficient recovery process.

- A critical component of this process is identifying potential sources of contamination within your premises and taking proactive steps to address them. This includes:
  - ✓ Identifying ways to remove or reduce contamination hazards, including emerging risks such as PFAS, microplastics, and other persistent contaminants.
  - Recognising vulnerable receptors of contaminants that could lead to significant damage, financial loss, or health impacts.
  - ✓ Implementing precautions to prevent the spread of contamination during and after fire incidents e.g. containment and bunding.
  - ✓ Reduction or substitution of particularly hazardous chemicals and agents.
  - ✓ The use of fire resisting compartments to help reduce the potential for the spread of harmful agents within smoke plumes.
  - $\checkmark$   $\,$  Control of combustible materials to help reduce the fire load and potential for fire growth.
- Should a fire occur, effective mitigation of contamination can be achieved by:
  - ✓ Determining the extent of contamination following an incident through comprehensive testing and monitoring (e.g., soil, air, water, and building materials).
  - ✓ Taking immediate action to mitigate contamination or corrosion caused by fire-related chemicals, heavy metals, asbestos fibres, and corrosive substances etc.
  - ✓ Implementing an emergency response/salvage plan that considers the safe handling and recovery of affected stock and materials while minimising further damage.
  - ✓ Identifying suitable cleaning methods for affected building materials and surfaces, including specialist decontamination procedures for hazardous substances such as asbestos or PFAS.
  - Providing appropriate training and briefings for staff who will play crucial roles in mitigating contamination risks. This includes awareness of emerging contaminants and proper use of personal protective equipment (PPE).
  - Ensuring that plans and risk assessments remain current and incorporate lessons learned from incidents as well as updates on emerging risks.

# Checklist

A generic **Contamination Risk Assessment and Plan** is presented in Appendix 1 which can be tailored to your own organisation.

# **Specialist Partner Solutions**

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

Business Resilience Horizonscan

For more information please visit: Aviva Risk Management Solutions – Specialist Partners

# Sources and Useful Links

- Health and Safety Executive <u>A11 Asbestos Essentials: Removing asbestos cement (AC) debris</u>
- Fire Brigades Union <u>Protect yourself against contaminants</u>
- London Fire Brigade <u>Fire Contaminants Policy</u>, <u>Environmental protection</u>, <u>Hazardous material</u> <u>response capability</u>
- <u>Natural Resources Wales' Fire Prevention and Mitigation Plan Guidance</u>
- The Fire Protection Association's article on PFAS
- UK Air Quality website's guidance on "Reducing air pollution from outdoor burning"
- Scottish Environment Protection Agency (SEPA) <u>containment of bulk hazardous liquids at</u> <u>COMAH establishments</u>

**Note:** Whilst UK standards and legislation are referenced in this document, other international standards and legislation should be referenced where applicable.

# **Additional Information**

Relevant Aviva Loss Prevention Standards include:

- Preventing Pollution from Fire Fighting Run-off
- Smoke Contamination
- Business Continuity Management
- Third Party Property Exposures
- Business Impact Analysis

To find out more, please visit <u>Aviva Risk Management Solutions</u> or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.\*

\*The cost of calls to 03 prefixed numbers are charged at national call rates (charges may vary dependent on your network provider) and are usually included in inclusive minute plans from landlines and mobiles. For our joint protection telephone calls may be recorded and/or monitored.

# Appendix 1 – Contamination Risk Assessment and Plan



Location / Building Name	
Date	
Completed by (name and signature)	

	Potential Contaminants	Y/ N	Details of Inventory / Location
1.	Chemicals		
2.	Asbestos		
3.	Large inventories of plastics		
4.	Process gases		
5.	Neighbouring premises		
6.	Lithium-ion battery storage and use		
7.	Other		

	Vulnerable Receptors	Y/ N	Details
8.	Clean rooms and high purity areas		
9.	Sensitive equipment/machinery		
10.	High value items		
11.	Neighbouring premises		
12.	Sensitive environmental receptors		
13.	Ventilation systems		
14.	Building materials		
15.	Other:		



	Prevention and Controls	
16.	Steps taken to reduce hazard potential of contaminants including mould	
17.	Steps taken to limit spread of smoke and contamination within the building(s)	
18.	Arrangements for determining extent of contamination following a fire	

	Salvage	Arrangements
19.	Power isolation	
20.	Ventilation of smoke affected areas	
21.	Water removal and dehumidifying	
22.	Items requiring corrosion inhibitor	
23.	Stocks or tarpaulins, sheets and covers, mops, squeegees, etc.	
24.	Tools and specialist moving equipment	
25.	Ensuring building security	
26.	Cleaning of building materials and surfaces	
27.	Staff training and briefings	
28.	Other:	



28. Additional comments:

# Please Note

This document contains general information and guidance only and may be superseded and/or subject to amendment without further notice. Aviva has no liability to any third parties arising out of ARMS' communications whatsoever (including Loss Prevention Standards), and nor shall any third party rely on them. Other than liability which cannot be excluded by law, Aviva shall not be liable to any person for any indirect, special, consequential or other losses or damages of whatsoever kind arising out of access to, or use of, or reliance on anything contained in ARMS' communications. The document may not cover every risk, exposure or hazard that may arise, and Aviva recommend that you obtain specific advice relevant to the circumstances.

31<sup>st</sup> May 2024

Version 1.5

ARMSGI2672025

Aviva Insurance Limited, Registered in Scotland Number SC002116. Registered Office: Pitheavlis, Perth PH2 0NH. Authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority.