Tank Farms – Property

With large quantities of hazardous materials stored on-site, tank farms present a number of fire, explosion and contamination hazards.

This Loss Prevention Standard discusses these hazards and provides guidance on managing the risks associated with tank farms.

Version: 1.4
Date: 29th October 2025

Tank Farms – Property

Introduction

A tank farm or fuel farm is a hazardous storage facility where products are stored in large quantities in fixed bulk tanks aboveground or underground.

Tanks can store a range of materials; however, highly flammable, combustible, reactive, toxic or incompatible materials, stored in large volumes or in adjacent tanks cause the most concern from a property loss prevention perspective. Specific material, hazard, operability and activity risk assessments will help to reduce all aspects of risk.

For guidance on tanker loading and unloading activities, refer to the Aviva Loss Prevention Standard **Road Tanker Loading and Unloading**.

Note: This Loss Prevention Standard relates to Tank Farms and is focussed on property loss prevention and related risk management guidance. It is not intended to address liability exposures. The presumption is that all regulatory requirements, such as fire risk assessments and compliance with local building regulations, codes, or standards, have or will be met.

Understanding the Risks

Fires and property losses involving hazardous liquids on tank farms can be caused by:

- Inadequate design.
- Second hand use – tank not designed for current materials.
- Poor maintenance.
- Lack of or inadequate training for individuals handling these substances or equipment.
- Inappropriate operational procedures and/or design of equipment.
- Inadequate control of ignition sources.
- Poor housekeeping.
- Inadequate management.
- Cost reduction programmes.

The risks include:

- **Fire**. Common ignition hazards include electrical faults, static or sparking, hot works, overheating machinery, etc.
- **Fire Type.** A number of fire types, each with their own characteristics depending on the materials stored, tank pressures and environmental factors including jet fires, pool fires, flash, fireballs and pyrophoric (materials that ignite upon contact with air or moisture).
- **Explosion**. Ignition of flammable vapours when confined can lead to explosion events. Explosions can be confined to the tank or unconfined, and the effects of the explosion are often amplified by the materials in proximity and the local terrain.

- **Spillage**. Leaking tanks can damage property and cause contamination of property, land and water supplies.
- **Impact**. Vehicles can impact containment structures, tanks, pipework, relief valves, drains, gantries, etc.
- **Breakdown**. Machinery breakdown, faults, blockages, etc., to tanks, pipework, containment structures and safety systems including overfill sensors, pressure relief valves, etc., can result in overfilling incidents.
- **Chemical Reaction**. Some materials may react when in contact with other chemicals, water, metals, etc., causing heating, corrosion or other damage. This should be considered within risk assessments.
- **Collapse**. Vacuums can form in tanks, potentially leading to deformation and collapse.

Risk Assessment

Risk Assessment

Given the risks associated with tank farms, risk assessments may be required under local/national regulations, standards or codes.

In the United Kingdom this is typically addressed within:

- The various home nation fire risk assessment-based legislations.
- The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)
- Control of Major Accident Hazards Regulations (COMAH).

The requirement to consider the risks under the COMAH Regulations is dependent on depending on the materials and volumes stored. Further detail is published by the Health and Safety Executive here.

Any risk assessments relating to tank farms, and the bulk storage of chemicals, flammable liquids or gases within, should be completed by competent persons, in line with recognised assessments techniques, such as:

- **HAZOP (Hazard and Operability Study)**. A method of risk assessment that identifies hazards and the possible outcomes or consequences of a loss event.
- **HAZID (Hazard Identification)**. Generally used during design and early concept stages.
- **LOPA (Layer of Protection Analysis)**. A method of evaluating risk and determining if existing safeguards are adequate by assessing the likelihood and severity of hazardous events and the effectiveness of the various protection layers.
- **Fault Tree Analysis (FTA)**. A method that looks at potential failures and works back to the possible causes.
- **Event Tree Analysis (ETA)**. A method that looks at potential initiating events and the possible outcomes or consequences.

Any identified corrective actions should be monitored until and after completion.

Note: Regulatory risk assessments are deemed a minimum requirement, and following the recommendations in this document can help further reduce risk exposures.

Material Damage Risk Assessment

Before initiating risk management controls or installing any additional fire detection and protection systems, an assessment of the anticipated/potential financial losses, for both material damage and business interruption exposures, in the event of a significant or catastrophic loss event, should also be undertaken.

This helps ensure that risk controls, fire detection and protection systems, etc., are sufficient and reflective of the potential property loss estimates.

Refer to the Aviva Loss Prevention Standards **Material Damage Risk Assessment** and **Business Impact Analysis** for further guidance.

Managing Change

Any proposed changes to business activities, equipment and the premises for risk management purposes should be managed through a formal Management of Change (MoC) process. This helps ensure all stages of the change are progressed with minimal exposure to the existing arrangements.

Changes to tanks and associated equipment including bases, storage methods, material stored, filling/emptying processes, etc., should also result in the LOPA being reviewed to ensure adequacy of current and/or proposed safety arrangements, by experienced and competent persons who understand the process, design and materials being stored.

Note: These proposed changes should be discussed with your Property Insurer and Insurance Broker.

Refer to the Aviva Loss Prevention Standards **Managing Change** for further guidance.

Managing the Risks

Materials Being Stored

Attention should be given to the material being stored, or multiple materials being stored in the same or adjacent tank farms, including:

- The volumes of materials stored, compared to the volumes needed to be stored.
- Its physical characteristics at the expected temperature and pressures within the storage tank.
- Its physical characteristics if it was released reflecting worst and best-case atmospheric conditions, e.g., Winter vs Summer.

Furthermore, assess whether the materials being stored:

- Are liquid, gas or solid.
- Are explosive, combustible, flammable, toxic, corrosive or reactive.
- Create static – and if so, whether precautions have been taken to eliminate it.
- Are likely to cause erosion or corrosion to the transfer network.
- Are incompatible or reactive if there is a release or leak, this includes escape into sumps or drainage systems.
- Are maintained with specific temperature or pressure requirements.
- Are quality controlled to prevent the introduction of contaminants and meet product quality needs.

Sludge

Sludge or sediment build-up is a common problem inside tanks storing materials such as crude oils. Sludge can reduce storage capacity, reduce flows and block pipes and valves. Injecting oil under pressure through a revolving internal jet stream, located centrally at the base of the tank, will break up the sediment. These anti-sludge systems are often built in situ.

Location and Topography

Regarding the location of tank farms, specific thought should be given to the:

- Nature of the surface and its porosity.
- Topography of the land and surrounding area. The surface should be firm and level.
- Distance of the station from exposed assets, including buildings, tanks, and equipment.
- Distance from any pumps or control features, and the site boundary.
- Transport passing by or in close proximity.
- Accessibility required for the emergency services.
- Drains or sewers nearby.
- Rivers or streams exposed.
- Nature of the surrounding areas, for example commercial, industrial, or natural/rural.

Environmental Conditions

Materials behave completely differently with different atmospheric and environmental conditions. Risk assessments need to include the maximum and minimum expected:

- Wind conditions.
- Temperature.
- Rainfall.
- Snow.
- Humidity.

Computational Fluid Dynamic (CFD) modelling is a technique used to assess how gases and liquids behave under various conditions and may support the risk assessment process.

Appropriate environmental monitoring or signalling should be provided, from a basic windsock to rotameters and temperature recording. With this in place, if a loss of containment occurs, the behaviour of the materials being stored may be predicted and acted upon accordingly.

Tank Design

Bases

Tanks should be located on a liquid sealed surface – normally concrete – to prevent their contents from leeching into the soil, causing environmental contamination and polluting the water table below. To minimise corrosion, tank bases should ideally be on plinths raised above the floor of the spillage containment area.

Tanks should be physically secured to the ground. If a tank is not secured, a liquid release could cause it to ‘float’, depending on the volume being stored in the tank compared to the volume of the retention. Floating tanks can damage piping, infrastructure, and other tanks, and cause incidents to escalate.

Tanks

The tanks and associated equipment should be designed for the specific purpose and materials being held, this extends to pipework, flanges, pumps and seals, valves, etc.

Ensure tanks are compliant with local/national regulations, standards or codes, such as **BS EN 14015: Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient temperature and above**, in the United Kingdom.

Roofs

Tank roofs can be:

- Fixed – it does not move.
- Floating – moves up and down with content fluctuations.

Floating roofs whilst helping to reduce vapour losses, present a number of challenges, including:

- **Seal Wear and Failure**. Seals can wear and eventually fail.
- **Buoyancy**. Floats or pontoons installed within floating roof structure to retain buoyancy can decay or become damaged, potentially causing the roof to sink.
- **Weather Exposure**. Extreme weather events such as storms, high winds, etc., can damage the roofing, exposing contents, causing vapour release, etc.
- **Water Drainage**. Inadequate or poor drainage channels from the roof can allow pooling/ponding damaging the roof.
- **Degradation**. Some materials can degrade when exposed to stored contents.

Ensure floating roof systems are compliant with local/national regulations, standards or codes, in the United Kingdom this is addressed via **BS EN 14015**, and subject to formal maintenance and inspection in line with Original Equipment Manufacturer (OEM) and industry guidelines.

Separation

The separation and distances between the tanks should vary depending on the type of product stored, the nature of the separation and the arrangements for spillage or release containment. Consider if a release from one tank could escalate an incident with other tanks – including in the event of a delayed ignition and fire or explosion, or a reaction with residues or other spillages on the ground. Measures should be in place to ensure materials cannot be loaded into the wrong tanks, possibly containing incompatible materials.

Fire Resistance

The tank's material of construction, including component parts, e.g., mastics, nuts and bolts, etc., should be non-combustible and compatible with the material being stored. Tanks must be able to withstand direct flame impingement for a period of time based on their construction and protection. Masonry, concrete or protected steel tank supports should have a fire resistance rating appropriate for the risk – either one, two or four hours – and be designed to prevent liquid ingress.

Labelling

Each tank should have:

- A data plate indicating its year of build, volume, and material of construction.
- Clear labels identifying exactly what is stored within.
- Instrumentation indicating the quantity of material stored.

Safety Features

Depending on the materials being stored, the tanks could or should have:

- Breather vents.
- Emergency relief valves and vents.
  - ✓ Discharging to a safe location.
  - ✓ Designed to relieve over-pressure from an exposing fire.
- Flame arrestors and Flare Headers.
- Evaporators.
- Access platforms or walkways.
- Associated pipelines, valves and transfer pumps – consider:
  - ✓ Their locations.
  - ✓ Whether they increase or decrease the exposure to the tanks.
  - ✓ Whether they are accessible in an emergency incident.
- Alarming and control equipment with:
  - ✓ In-built redundancy.
  - ✓ Hardwired safety interlock or shutdowns, such as:
    - Level monitoring and control.
    - High- level alarms and interlocks.
    - Low level alarms and interlocks.
- Ancillary equipment, such as compressors.
- Separate area for loading and unloading.
- Lightning protection.
  - ✓ Refer to Aviva Loss Prevention Standard – **Lightning Protection**.
- Lighting and emergency lighting.

Additional Considerations

A tank may have:

- Internal or external heating, applied with:
  - ✓ Hot water.
  - ✓ Steam.
  - ✓ Electrical.
  - ✓ Thermal oil systems.
- Externally applied insulation (consider how often this is checked for impregnation).
- Stirrer or internal agitation.

These features can:

- Impact the tank's material characteristics.
- Create failure mechanisms.
- Cause corrosion or rust.
- Introduce increased fire hazards.
- Cause machinery breakdown issues.
- Create material ingress and egress exposures.

Entry

Tanks will be considered as a confined space and regardless of the materials being stored, they should only be accessed internally using a formal confined space entry procedure issued by a competent person.

Cross-contamination

Tanks may have potential for cross-contamination, impurities or leaching in the material currently being stored. Consider if a tank is used solely for one material, and what it has stored previously.

Vacuum Considerations

Vacuums occur in storage tanks when the internal pressure drops below atmospheric pressure. This can result in tank deformation or collapse and is of specific concern in tanks that have not been designed and built to operate under higher pressures. Vacuums commonly occur when tank contents are pumped and air cannot enter the tank quickly enough to equalise the pressure. Other causes include:

- Vents becoming blocked and preventing air entering the tank.
- Incorrect venting that may lead to slow air infill when contents are pumped out of the tank.
- Changes in the ambient temperature or cooling of tank contents can lead to vapours contracting and a reduction in internal pressure.
- Overfilling can create a siphon effect when the inlet is closed, effectively pulling liquid out.

Ensure venting is sufficient for the tank size and specification, planned or expected fill/empty rates and the materials stored.

Regular maintenance and inspection of venting should be undertaken.

Containment

To prevent an uncontrolled material release escaping the confines of the area where the tanks are located, there should be appropriate containment, including:

- At least 110% capacity of the contents of the largest container or 25% of their total storage capacity, whichever is the greater.
- Walls of appropriate stability to hold and withstand the static and dynamic forces from a tank liquid release.
- Walls of appropriate height and distance from the tanks to prevent a spigot flow over the containment wall.
- Ensure adequate impact protections are installed.

The rationale for the largest expected volume should be clearly understood – it may be in excess of the largest single tank volume.

In addition, containment should be:

- Liquid tight – no valves should be fitted into the containment.
- Able to be drained of rainwater.
- Maintained clear of all materials, waste and vegetation.

Precautions and Controls

There should be restrictions to entering a tank farm area, including:

- Restricted or prohibited areas.
- Visitor and contractor controls.
- Control of certain materials.
- Restricted equipment and tools, including mobile phones.
- Smoking prohibition.

Additional issues to consider include:

- Appropriate process controls and hardwired interlocks.
- Appropriately located emergency manual shutdown buttons for equipment.
- Barrier walls or fire compartment walls between tanks.
- Fire retardant or fire-resistant coatings for tank supports, pipe racks, cable trays, etc.

- Earthing and bonding for each tank, subject to regular continuity testing.
- Ventilation.
- Ensuring that activities are always completed by trained personnel.
- The use of appropriately rated devices, equipment, vehicles, clothing and footwear, for any area classified as having the potential for an explosive or flammable atmosphere.
- The use of designated vehicle routes with impact barriers.
- Designated personnel routes and appropriate barriers from tanks and associated equipment and structures.
- Clear and appropriate signage, such as traffic rules or emergency instructions.
- Drain covers – ensuring they are always in place and undamaged.
- Appropriate lighting.
- Separation distance from other structures and equipment, exposed assets and buildings, including open windows or doors.
- Appropriate management controls and permit controls for any work associated with the tank farm.
- Control of ignition sources.
- Ensuring all storage and waste is housed at least 10 metres away from the tank farm.
- Housekeeping, vegetation growth and waste control maintenance.

Hot Work Operations

Any Hot work activities, which includes the use of welding equipment, blowtorches, grinders, drilling and brazing etc., should be prohibited within proximity of any tanks where flammable liquids, gases or vapours may be present.

Any such works should be removed to a 'safe' location or only be completed via 'cold' methods.

Important: Where this is not possible hot works **MUST** be considered the last resort and should be conducted following a specific risk assessment and in strict accordance with the Aviva Loss Prevention standard **Hot Work Operations.** The following actions must also be implemented:

- Tanks, pipework and associated equipment within at least 10 metres of the proposed work location to be purged of any flammable liquids, gases and vapours. This should be verified.
- Combustible or flammable materials must be removed a distance of at least 10 metres.
- All other activities in the area associated with high hazard materials such as flammable liquids, combustible dusts, gases, etc., must be stopped for the duration of the hot work task and following fire watch.
- Conduct gas testing within a 15-meter radius of the hot work zone.
- The work area atmosphere must be continuously monitored for flammable vapours using appropriately calibrated organic vapour detection devices, including within any sumps or containment structures.
- Fire watches must be undertaken for 240 minutes after the hot works.
- Thermographic cameras, appropriately rated for use in environments where flammable vapours may be present, to be used throughout the process and fire watches.

Refer to Aviva Loss Prevention Standards **Hot Work Operations** and **Use of Thermographic Cameras – General Considerations** for further guidance.

Fire Detection and Protection Systems

When installing and operating fire detection and protection systems, consideration should be given to the nature of the material and its state, the ambient conditions, the exposure, etc., along with the following:

- Volatile organic content detection.
- Toxic content detection.
- Interlocks to automatically shut down any material transfers safely.
- Manual shut down buttons at safe and readily accessible locations for operators, i.e., within safe control rooms and supporting kill switches at the site entrance in the event of major event.
- Automatic fire detection.
- Automatic and/or manually activated:
  - ✓ Water curtains or water sprays to knock down gases or vapours.
  - ✓ Sprinklers or deluge systems to help control and where possible, extinguish fires.
    - For the outside of the tank(s) itself.
    - For the wider containment area.
    - For associated pumping or transfer equipment.
    - For associated piping runs, pipe racks or bridges.
  - ✓ For exposure protection the recommended arrangement is normally:
    - An automatically and manually actuated deluge system.
    - Density of 10 to 12 mm/min/m^2 over all and any surface area of the tank(s).
  - ✓ This can be foam enhanced.
  - ✓ Depending on the material in the tank, foam injection into the vapour space of the tank may be an option:
    - The nature of the foam has to be specifically based on the material in the tank.
    - The method of foam injection has to be based on the foam being used, e.g., above the liquid surface within the tank or below the surface within the tank.
  - ✓ Foam blankets/foam pouring for the containment area.
  - ✓ Two separate means of activating manual fire protection or deluge systems should be provided, remotely sited from the tank locations and at least 15 metres apart from each other.
  - ✓ Automatically oscillating monitor nozzles or water cannons directed to the tank surfaces:
    - These can be foam enhanced.
    - If manually activated monitor nozzles or water cannons are employed, appropriate consideration should be given to exposure reduction measures for operators.
  - ✓ Exposure protection for exposing building walls, activities, process equipment, etc.
  - ✓ Fire water hydrants in the area generally at least every 75m and available on all sides of the tank farm.

Note: In all cases where foam is employed, the foam needs to be appropriate for the materials being stored in the tanks and the design of the protection needs to be based on this foam selection.

Important: Discuss any plans to install or upgrade fire detection or protection systems with your insurer or broker.

Refer to Aviva Loss Prevention Standard **Manual Fire Fighting Water Supplies** for further guidance.

Emergency Response

Formal consideration to various events and appropriate formal emergency response plans should be in place for such activities. These should consider what could fail, what could go wrong and how it could escalate. The plan should be practiced at least annually and should involve the local public resources and any third-party organisations or contractors that are used. Depending on the nature of the materials being stored or the volumes involved, these emergency plans may need to meet regulatory criteria such as COMAH.

Consideration should also be given to the capture and management of firefighting water runoff. This has the potential to cause widespread environmental damage and can lead to significant expense in removing and clean up costs. The local Fire and Rescue Service are usually amenable to visiting premises to offer guidance and consider their emergency response.

Refer to Aviva Loss Prevention Standard **Emergency Response Teams** for further guidance.

Training

Training for personnel associated with operations involving potentially hazardous materials is a key component, and should cover:

- What is normally expected to happen.
- What could happen in a number of emergency situations.
- How they are expected to respond.
- Own personnel and contractors or third parties.
- Hazards associated with the substances being stored.

Inspection, Testing and Maintenance

Appropriate inspection, testing and maintenance activities for all items associated with the tank farm should be carried out and given formal records, including:

- Process controls.
- Control or emergency interlocks.
- Tank internal and external surfaces – such as checks for signs of rust and corrosion.
- Tank welds.
- Pumps and seals
- Connections and flanges.
- Tank wall thickness.
- Tank sediment or sludge accumulation removal.
- Heating or cooling systems.
- Insulation.
- Agitators or stirrers.
- Exercising breather valves.
- Valves or relief systems.
- Containment bund walls and floor surface.
- Lightning conduction.

Ensure maintenance workers are appropriately trained and all work is carried out in accordance with formal Permit to Work arrangements.

Refer to Aviva Loss Prevention Standards Managing Contractors – Property, **Self-Inspections** and **Maintenance Regimes** for further guidance.

Checklist

A generic Tank Farms Checklist 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.

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

Sources and Useful Links

- Health and Safety Executive (HSE) – L111: The Control of Major Accident Hazards (COMAH) Regulations 2015
- HSE – HSG176: Storage of flammable liquids in tanks
- HSE – L138: Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) – Approved Code of Practice and Guidance
- HSE – HSG244: Remotely operated shutoff valves (ROSOVs) for emergency isolation of hazardous substances
- RISCAuthority – RC57: Recommendations for fire safety in the storage, handling and use of highly flammable and flammable liquids: storage in external fixed tanks
- Seveso III Directive – Directive 2012/18/EU
- National Fire Protection Association (NFPA) – NFPA 11: Standard for Low, Medium and High Expansion Foam
- NFPA – NFPA 13: Standard for the Installation of Sprinkler Systems
- NFPA – NFPA 15: Standard for Water Spray Fixed Systems for Fire Protection
- NFPA – NFPA 16: Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA – NFPA 30: Flammable and Combustible Liquids Code

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:

- **Road Tanker Loading and Unloading**
- **Flammable Liquids**
- **Emergency Response Teams**
- **Hot Work Operations**
- **Maintenance Regimes**
- **Managing Change – Property**
- **Managing Contactors – Property**
- **Self-Inspections**

To find out more, please visit Aviva Risk Management Solutions **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 – Tank Farms Checklist

Location	
Date	
Completed by (name and signature)	

	Tank Farms	Y/N	Comments
1.	Have specific risk assessments been completed – and reviewed periodically or when there are changes – in respect of: • Hazard? • Material? • Operability? • Activity?		
2.	Are OEM records and P&ID drawings (Piping and Instrumental Diagrams) retained?		
3.	Are the materials stored quality checked to ensure they are not introducing contaminants and meet product quality needs?		
4.	Can the volumes stored on site be reduced or the hazardous material be changed for a less hazardous one (subject to MoC)?		
5.	Are the physical characteristics of the material(s) involved fully understood? • At the expected temperature and pressures within the storage tank? • If it was released at expected worst- and best-case atmospheric conditions? • Is it a liquid, gas or solid? • Is it: ✓ Explosive? ✓ Flammable? ✓ Toxic? ✓ Corrosive? ✓ Reactive? • Does it create static? • Is it likely to cause erosion or corrosion to the tank or transfer network? • Is it water miscible? • If a gas or a vapour is generated, is it heavier than air? • What is boiling point and other critical temperatures?		

6.	• If multiple different materials are stored in the same tank farm, are any of them reactive or incompatible with each other? • Are appropriate precautions taken to minimise interaction if the materials are released?		
7.	Are the materials being stored maintained within specific temperature or pressure requirements?		
8.	Have sources of ignition been removed from the area?		
9.	Is the formation of a sludge/sediment an exposure within the tank?		
10.	If a material is released, can it form a vapour or gas that could contaminate other equipment or any control instrument?		
11.	Does the nature of the tank farm increase the risk posed, due to: • Nature of the surface and its porosity? • Gradient of the surrounding ground surface? • Distance from exposed assets, including buildings, other tanks, equipment, and tankers loading and unloading? • Distance from any pumps or control features? • Transport passing by or in close proximity? • Drains or sewers nearby? • Rivers or streams exposed? • Nature of the surrounding areas, for example, commercial, industrial, or natural?		
12.	Does the activity expose assets and/or buildings, including: • Open windows or doors? • Ventilation air intake events?		
13.	When considering the nature of the materials and the location of the tank farm, do the risk assessments include the maximum and minimum expected: • Wind conditions? • Ambient temperature • Rainfall? • Snow or ice? • Humidity?		
14.	Is appropriate environmental monitoring and signalling equipment provided, such as a windsock or rotameter?		
15.	Are all tanks constructed with materials consistent and compatible with the materials being stored?		

16.	Do all tanks have a data plate indicating year of build, volume, and material of construction?		
17.	• Are all tanks constructed of non-combustible materials, such as steel or concrete? • Have they been designed to an appropriate standard?		
18.	Do the tanks have: • Fixed roof tanks? • Floating roof tanks? • Where floating, are the roof systems compliant with local/national regulations, standards or codes, e.g., BS EN 14015 in the United Kingdom.		
19.	Are all tanks located on a liquid sealed surface?		
20.	Are all tanks designed to withstand direct flame impingement?		
21.	Are tanks provided with any supports, and are these protected against fire?		
22.	Are the tanks located on plinths or raised bases?		
23.	Is there an appropriate confined space entry procedure in place and enforced for all tank entry?		
24.	• Are all tanks clearly labelled, indicating the: ✓ Contents within? ✓ Volume of the tank? • Are all pipelines clearly labelled? • Are tanks fitted with instrumentation controls to indicate the quantity of substance stored within them?		
25.	• Are all tanks physically separated or detached from each other? • What is the separation distance? • Are there fire barrier or containment walls?		
26.	• Can a release from one tank create or escalate an incident with other tanks? • Is there potential for delayed ignition or detonation?		
27.	• Where required, do all tanks have: ✓ Breather vents? ✓ Emergency relief valves and vents? • Do relief systems discharge to a safe location? • Are relief systems designed to relieve over-pressure from an exposing fire impinging or exposing the tank? • Are vents and relief systems fitted with appropriate flame arrestors?		

28.	• Are there any associated: ✓ Evaporators? ✓ Access platforms or walkways? ✓ Pipelines? ✓ Valves? ✓ Transfer pumps? ✓ Where are these located? • Do they increase or decrease the exposure to the tanks? • Are they accessible in an emergency incident?		
29.	• Is there appropriate process control and alarming equipment? • With in-built redundancy? • With hardwired safety interlock/shutdowns?		
30.	• Are there: ✓ High-level alarms and interlocks? ✓ High-high level alarms and interlocks? • If applicable, are there alarms and interlocks at: ✓ Low and low-low level? ✓ High and high-high temperature? ✓ Low and low-low temperature? ✓ High and high-high pressure? ✓ Low and low-low pressure?		
31.	• Do the tanks and associated equipment have internal or external heating? • How is this applied (hot water, steam, electrical, thermal oil systems)? • Would its failure cause any issues with the material being stored?		
32.	• Do the tanks and associated equipment have externally applied insulation? • Is this non-combustible in nature? • Is this checked for impregnation or contamination, and how often?		
33.	• Do any of the tanks have a stirrer or internal agitation? • Would its failure cause any issues with the material being stored?		
34.	• Are the tanks used solely for a single material, now and/or in the past? • Is there potential for cross-contamination from impurities or leaching in the material currently being stored?		
35.	Is there a separate area for tanker loading and unloading?		
36.	Is there appropriate lightning protection?		

37.	Is there appropriate lighting, including emergency lighting for the tank farm area?		
38.	• Is appropriate containment provided around the tank farm and tanks? • Will this prevent an uncontrolled material release escaping the confines of the area of the tanks? • Is this area: ✓ At least 110% capacity of the largest expected container or 25% of the overall storage capacity, whichever is the largest? ✓ Liquid tight (for both floor and walls)? ✓ Able to be drained of rainwater? ✓ Maintained clear of all materials, waste and vegetation?		
39.	Are the containment walls: • Of appropriate stability to hold and withstand the static and dynamic forces from a tank liquid release? • Of appropriate height and distance from the tanks to prevent a spigot flow over the containment wall? • Liquid tight?		
40.	Are there restrictions to entering a tank farm area? Does this include: • Restricted or prohibited areas? • Visitor and contractor controls? • Control of certain materials – and are these identified? • Restricted equipment and/or tools, including mobile phones? • Smoking prohibition, control and restrictions?		
41.	Are there appropriate management and permit controls for any work to be completed associated with the tank farm, such as confined space or hot work?		
42.	Are there appropriate process controls and hardwired interlocks?		
43.	Have emergency manual shut down buttons been located in two readily accessible and safe locations?		
44.	Do barrier walls or fire compartment walls need to be provided between tanks or tank farms?		
45.	Are fire retardant or resistant coatings required and provided for: • Tank supports? • Pipe racks supports? • Cable trays? • Ancillary equipment supports?		

46.	• Are earthing and bonding straps provided? • Are they formally inspected, tested and maintained? • Is there continuity testing?		
47.	Are activities always completed by trained personnel?		
48.	Are formal recorded inspection, testing and maintenance activities completed for all items in the process, including pressure relief valves?		
49.	• If the area is classified (due to the potential for an explosive or flammable atmosphere), are appropriately rated devices, equipment, vehicles, clothing and footwear used? • Is this monitored and audited?		
50.	Are barriers to prevent vehicle or personnel movements used?		
51.	Is there clear and appropriate signage?		
52.	• If there is potential for substances to enter drains, are appropriate covers used? • What about for an emergency release, or fire water run-off?		
53.	Is housekeeping, vegetation growth and waste control maintained to the highest standards, and not permitted within or outside of the containment bund?		
54.	Is all storage and waste housed at least 10m away from the tank farm?		
55.	If an organic liquid or gas is stored, has appropriate volatile organic content detection been provided?		
56.	• Is the area of the tank farm secure? • Is it: ✓ Within a secure fenced area? ✓ Covered by a Video Surveillance System system? ✓ Visited regularly throughout the working day? ✓ Visited regularly during idle periods?		
57.	If a toxic material is stored, has appropriate toxic material detection been provided?		
58.	• Is appropriate automatic fire detection provided? • Does this include throughout the containment bunded area, and covering all areas?		
59.	Where any detection is installed, have interlocks been provided to safely and automatically shut down operations?		

60.	Does a receipt of any fire or important process alarm elsewhere on-site result in the material transfer activities of the tank farm ceasing automatically and/or manually?		
61.	If there is concern for gas or vapour escape, have automatically and/or manually activated water curtains or water sprays been provided to knock down or adsorb such materials?		
62.	• Have automatically actuated sprinkler or deluge systems been provided to extinguish any potential fires? • Does this include: ✓ Within the containment bunded area? ✓ On the external shell of the tanks? ✓ For associated pumping or transfer equipment? ✓ For associated piping runs, pipe racks or bridges? ✓ Is the design of this at least 10mm/min/m^2 surface area? ✓ Is the foam enhanced?		
63.	Has exposure protection been provided to other assets or buildings nearby?		
64.	If there is potential for a release or a pool fire within a contained area, has appropriate foam or foam blanketing been provided?		
65.	Has foam injection into the vapour space of the tank been provided?		
66.	Are there water or foam/water automatically and manually activated monitor nozzles or water cannons? Do these cover all areas of the tank farm? If they are manually activated, are the positions of the monitor nozzles safe for operators in a fire?		
67.	If foam is employed in the fire protection strategy, is it compatible for the materials being stored in the tanks? Is the design of the protection based on this foam selection?		
68.	Are there appropriate fire hydrants in the area? Are at least two hydrants located in opposite directions within 75m of the tank farm? Is the available water supply known and considered acceptable?		
69.	Are formal emergency response plans in place, and do they consider: • What could fail? • What could go wrong? • How could an incident escalate? • Compliance with regulations?		

70.	Are emergency plans practised at least annually? Have the local fire brigade recently visited the site as part of a familiarisation visit?		
71.	• Do emergency plans involve: ✓ Liaison with local public resources? ✓ Any contractors or third-party delivery organisations? • Do the emergency services have satisfactory access to the tank storage area in the event of an incident? • Do emergency plans consider continuity of operations?		
72.	• Are hot works prohibited? • Where absolutely necessary, are hot works conducted per Aviva standards after purging and clearance? • Are thermographic cameras used during hot works and fire watches? • Are fire watches conducted for up to 240 minutes post-hot works?		
73.	• Is there formal recorded training for personnel associated with such operations? • Does this cover: ✓ What is normally expected to happen? ✓ Up-to-date Standard Operating Procedures? ✓ What could happen in a number of emergency situations? ✓ Up-to-date Emergency Operating Procedures? ✓ How individuals are expected to respond to an emergency. ✓ Own personnel and contractors or third parties? ✓ A combination of desktop and practical training?		
72.	Additional comments:		

Please Note

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29th October 2025

Version 1.4

ARMSGI1672019