UNECE Convention on the Transboundary Effects of Industrial Accidents

Workshop on Safety Guidelines and Good Industry Practices for Oil Terminals

EU Legislative and regulatory framework, safety standards and good industry practices

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UKpia

Introduction – UK Infrastructure

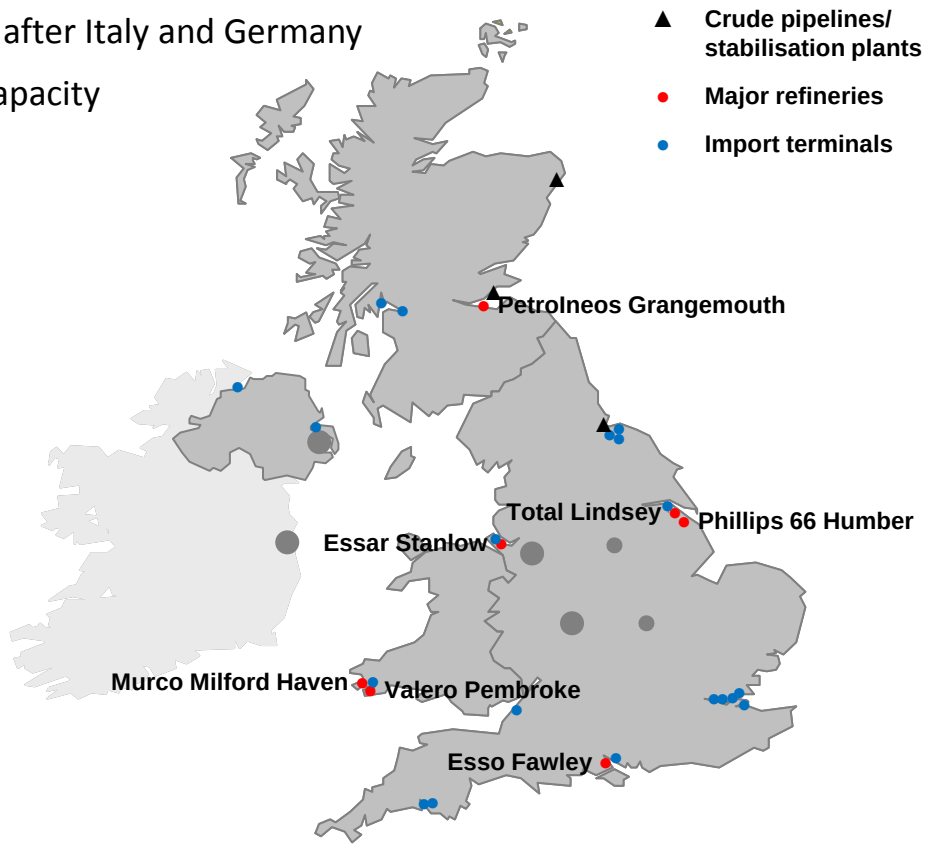
UKPIA is the trade association representing the non-commercial interests of nine companies involved in the UK downstream industry, whose interests cover refining, storage and distribution and marketing of petroleum products.

The UK has the third largest refining capacity in Europe after Italy and Germany

Seven major refineries (+2 bitumen)	73.5mt/year capacity
Major import terminals	10
Primary distribution terminals	40
Extensive product pipeline network	5000km

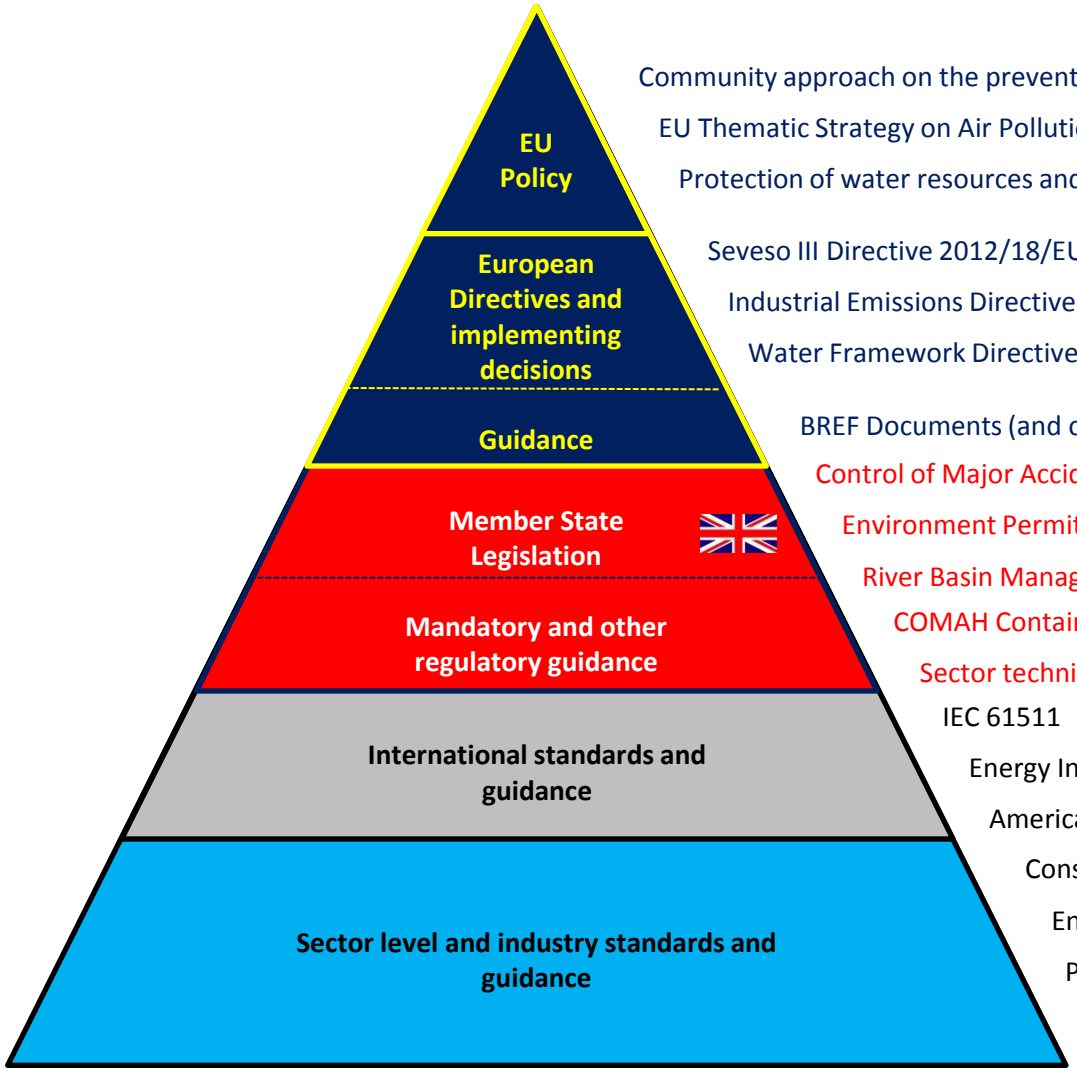
2012 Industry statistics (kt)[1]

Crude production	44561
Crude imports	60559
Crude exports	33961
Production	68690
Product imports	25978
Product exports	27083



1. Data taken from DECC Digest of UK Energy Statistics – see https://www.gov.uk/government/publications/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes.

European legislative and regulatory framework



Community approach on the prevention of natural and man made disasters

EU Thematic Strategy on Air Pollution

Protection of water resources and integrated sustainable water management

Seveso III Directive 2012/18/EU

Industrial Emissions Directive 2010/75/EU

Water Framework Directive 2000/60/EC and daughter Directives

BREF Documents (and other guidance)

Control of Major Accident Hazard Regulations 2005

Environment Permitting Regulations (England and Wales) 2010 (as amended)

River Basin Management Plans

COMAH Containment Policy, ALARP, AMN Guidance

Sector technical guidance, horizontal guidance, Regulatory Guidance Notes

IEC 61511

Energy Institute Guidance Documents and Standards (IP 19)

American Petroleum Institute (API) Guidance Documents and Standards

Construction Industry Research and Information Association (CIRIA)

Engineering Equipment and Materials Users' Association (EEMUA)

Process Safety Leadership Group (PSLG)

UK Chemicals and Downstream Industry Forum (CDOIF)

UK Petroleum Industry Association (UKPIA)

The Seveso Directive - history

- A number of major accidents occurred in Europe during the 1970s, most notably in Seveso, Italy, in 1976, where the accidental production and release of a dioxin as an unwanted by-product from a runaway chemical reaction led to widespread contamination. More than 600 people were evacuated from their homes and around 2000 were treated for dioxin poisoning.
- Such incidents led the European Commission to propose a Directive on the control of major industrial accident hazards. The first Seveso Directive was adopted in 1982. The Directive was amended twice to broaden its scope, in particular to include the storage of dangerous substances in response to severe accidents:

Union Carbide, Bhopal (1984)	Leak of methyl isocyanate caused more than 2500 deaths
Sandoz, Basel (1986)	Fire-fighting water contaminated with mercury, organophosphate pesticides and other chemicals caused massive pollution of the Rhine.

- The original Seveso Directive was replaced in 1996. Seveso II included revision and extension of the scope; including new requirements obligating Member States to ensure that operators have a policy in place to prevent major accidents.
- As a response to further accidents and studies on carcinogens and substances dangerous for the environment, the Seveso II Directive was extended in 2003 to cover risks arising from storage and processing activities for other dangerous substances:

Aurol, Baia Mare (2000)	Spill of mining waste water causing severe pollution of the Someş and Danube
SE Fireworks, Enschede (2000)	Fireworks explosion with 400 houses destroyed, 1500 homes damaged
AZF, Toulouse (2001)	Ammonium nitrate fertiliser explosion with 31 deaths and 2442 injured

The Seveso Directive – key requirements

- The Seveso II Directive included requirements obligating Member States to ensure that operators have a policy in place to prevent major accidents:
  - Operators handling dangerous substances above certain thresholds must regularly inform the public likely to be affected by an accident, providing safety reports, a safety management system and an internal emergency plan.
  - Member States must ensure that emergency plans are in place for the surrounding areas and that mitigation actions are planned. Account must also be taken of these objectives in land-use planning.
- The Directive describes a tiered approach: the larger the quantities of dangerous substances present, the stricter the rules ('upper-tier' establishments have bigger quantities than 'lower-tier' establishments and are therefore subject to tighter control).
- Most refineries and larger distribution terminals are classified as ‘upper tier’ establishments.
- The Seveso III Directive, published in July 2012, introduces a number of additional requirements:
  1. Technical updates to take account of changes in EU chemicals classification.
  2. Better access for citizens to information about risks resulting from activities of nearby companies, and about how to behave in the event of an accident.
  3. More effective rules on public participation in land-use planning projects related to Seveso plants.
  4. Access to justice for citizens who have not been granted appropriate access to information or participation.
  5. Stricter standards for inspections of establishments to ensure more effective enforcement of safety rules.
- Member States have to apply these rules from 1st June 2015, which is also the date when the new chemicals classification legislation becomes fully applicable in Europe.

Safety reports – required content (1)

1. Information on the management system and on the organisation of the establishment with a view to major-accident prevention.
2. A description of the establishment and its environment including the geographical location, meteorological, geological, hydrographic conditions and, if necessary, its history.
    a) Identification of installations and other activities of the establishment which could present a major-accident hazard and a description of areas where a major accident may occur.
    b) On the basis of available information, identification of neighbouring establishments etc. that could be the source of, or increase the risk or consequences of a major accident and of domino effects.
3. A description of the installation including:
    a) its main activities and products, sources of major-accident risks and conditions under which such a major accident could happen, together with a description of proposed preventive measures;
    b) A description of processes and operating methods
    c) An inventory and description of dangerous substances including physical, chemical, toxicological characteristics and an indication of associated hazards, both immediate and delayed for human health and the environment;
4. Identification and accidental risks analysis and prevention methods:
    a) A detailed description of the possible major-accident scenarios and their probability or the conditions under which they occur, including operational causes; external causes, such as those related to domino effects; and natural causes, for example earthquakes or floods.
    b) Assessment of the extent and severity of the consequences of identified major accidents including maps etc. showing areas which are likely to be affected by such accidents.

Safety reports – required content (2)

c) A review of past accidents and incidents with the same substances and processes used, consideration of lessons learned from these, and explicit reference to specific measures taken to prevent such accidents.

d) A description of technical parameters and equipment used for the safety of installations.

5. Measures of protection and intervention to limit the consequences of a major accident:

a) A description of the equipment installed in the plant to limit the consequences of major accidents for human health and environment, including for example detection/protection systems, technical devices for limiting the size of accidental releases, including water spray; vapour screens; emergency catch pots or collection vessels; shut-off valves; inerting systems; fire water retention.

b) Organisation of alert and intervention.

c) A description of mobilisable resources, internal or external.

d) A description of any technical and non-technical measures relevant for the reduction of the impact of a major accident.

A good safety report demonstrates systematically:

- What could happen at a major hazard site
- How accidents are prevented
- What is being done to ensure that if an accident occurred, the consequences can be minimised
- That a clear mitigation plan is in place

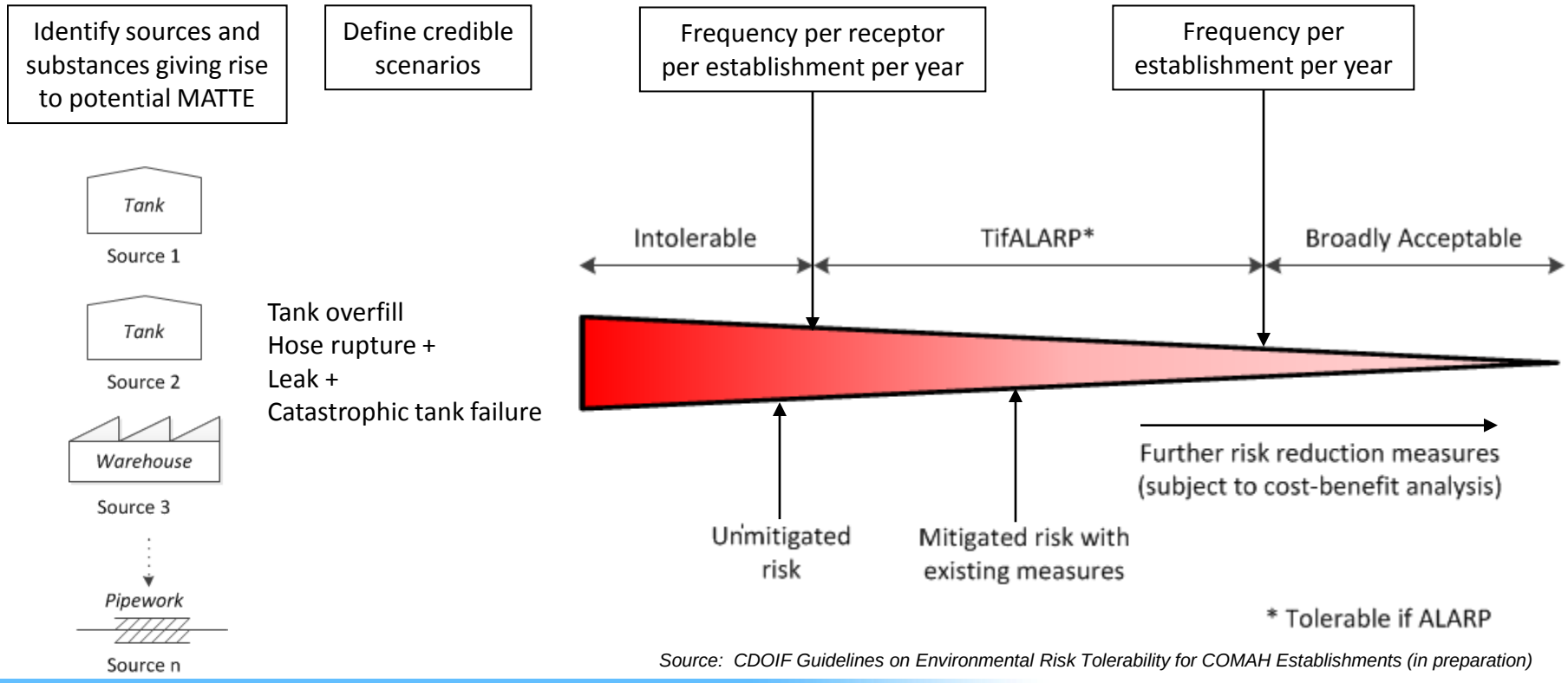
Safety standards and guidance

EU Mandatory guidance	IED BREF documents • Refinery BREF (in revision)
EU Advisory guidance	IPPC BREF documents • Emissions from storage • Economics and cross-media
Member State guidance	COMAH Containment Policy Safety Report Assessment Manual (provides guidance to regulators) Environment Agency Guidance for the Gasification, Liquefaction and Refining Sector Environment Agency cost-benefit analysis guidance for environmental risk assessment
International standards and guidance	IEC 61511 “Functional safety – Safety instrumented systems for the process industry sector” (covers design and management requirements for safety instrumented systems) Energy Institute “Model Code of Safe Practice Part 15: Area Classification Code for Installations Handling Flammable Fluids” Energy Institute “Model code of safe practice Part 19: Fire precautions at petroleum refineries and bulk storage installations” Energy Institute “Guidance on risk assessment and conceptual design of tertiary containment systems for bulk storage of petroleum, petroleum products or other fuels” ANSI/API RP 754 “Process Safety Performance Indicators for the Refining and Petrochemical Industries”
Sector level and industry standards and guidance	CIRIA 164 “Chemical storage tank systems - good practice guide” (in revision) EEMUA 217 “Safe and effective operation of storage tanks” EEMUA 159 “Users' Guide to the Inspection, Maintenance and Repair of Above ground Vertical Cylindrical Steel Storage Tanks” PSLG Report “Safety and environmental standards for fuel storage sites”

Risk assessment and mitigation

- The requirement to demonstrate appropriate risk assessment and mitigation is a key requirement under the Seveso Directive and Member State implementation of the Directive.
- Under the UK COMAH Regulations, operators are required to demonstrate that risks have been reduced to "ALARP" – as low as reasonably practical – using "AMN" – all measures necessary.
- A wide range of risk assessment methodologies is available, e.g. levels of protection analysis (LOPA), safety layer matrix analysis, calibrated risk graph, quantified risk assessment (QRA).

Environmental risk assessment process

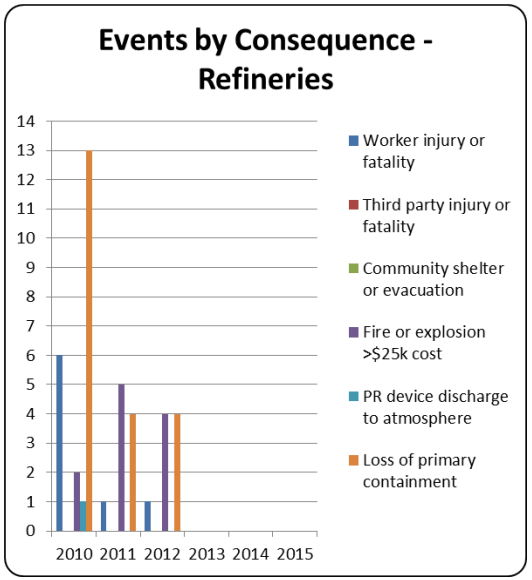


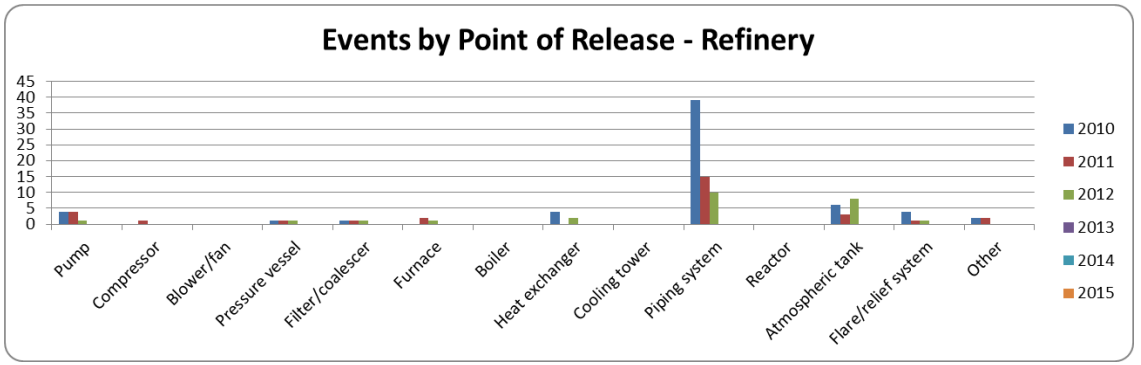
Source: CDOIF Guidelines on Environmental Risk Tolerability for COMAH Establishments (in preparation)

Process safety leadership – peer to peer review

- UKPIA member companies are reporting:
  1. All Tier 1 and Tier 2 events as defined by API RP 754
  2. Tier 3 events (challenges to overfill protection systems installed on finished gasoline tanks and small fires)
- Two reports are used to present the data collected:

External Report	Key information that may be used as an indication of ongoing sector performance in process safety, including process safety event rate (per million hours worked), number of Tier 1, Tier 2 and Tier 3 events and events by consequence.
Internal Report	Supplemental technical data that may be used to identify trends in performance to target where additional guidance may be required. These include events by mode of operation, point of release and material released.

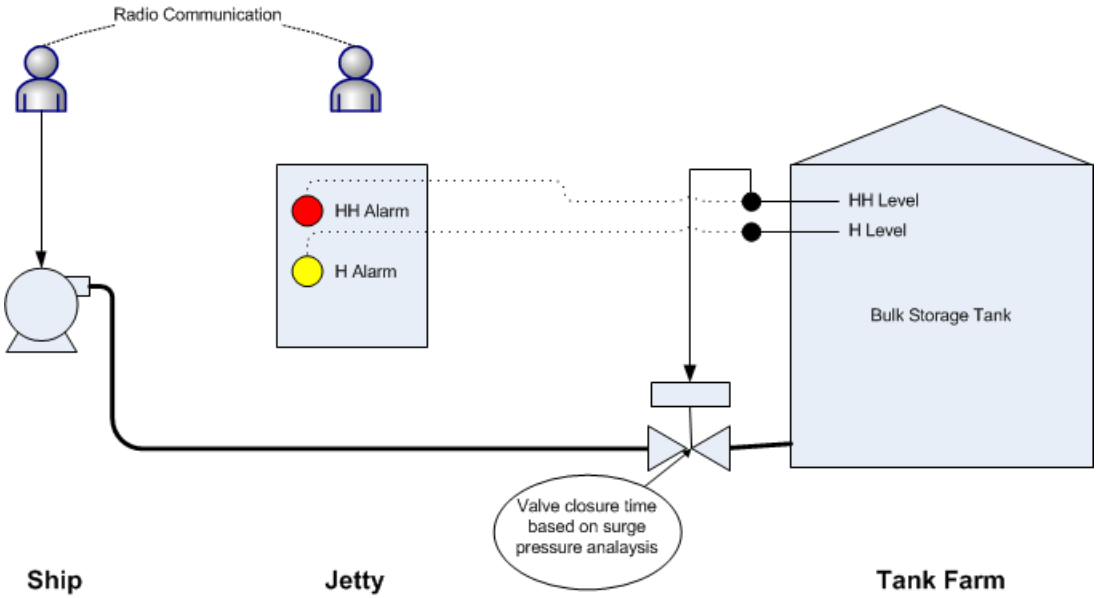




NOTE: Data is for information only, and is not based on actual returns

Automatic shutdown of ship transfers

- Buncefield MIIB Recommendation 3 requires that operators should protect against loss of containment of petrol and other highly flammable liquids by fitting a high integrity, automatic operating overfill prevention system.
- When closing import lines from ships, due to the activation of the overfill protection system, care must be taken to ensure against damage to pipelines and flexible hoses (and other related equipment) due to pressure surges or over-pressure. Such events can also lead to loss of containment.
- Possible solutions for tank overfill include diversion to another tank, automatic and delayed closure of tank side valves and trip of the ship discharge pumps, but all have associated potential issues. UKPIA has developed guidance including recommended system architecture:



Tanker loading operations and hazard awareness

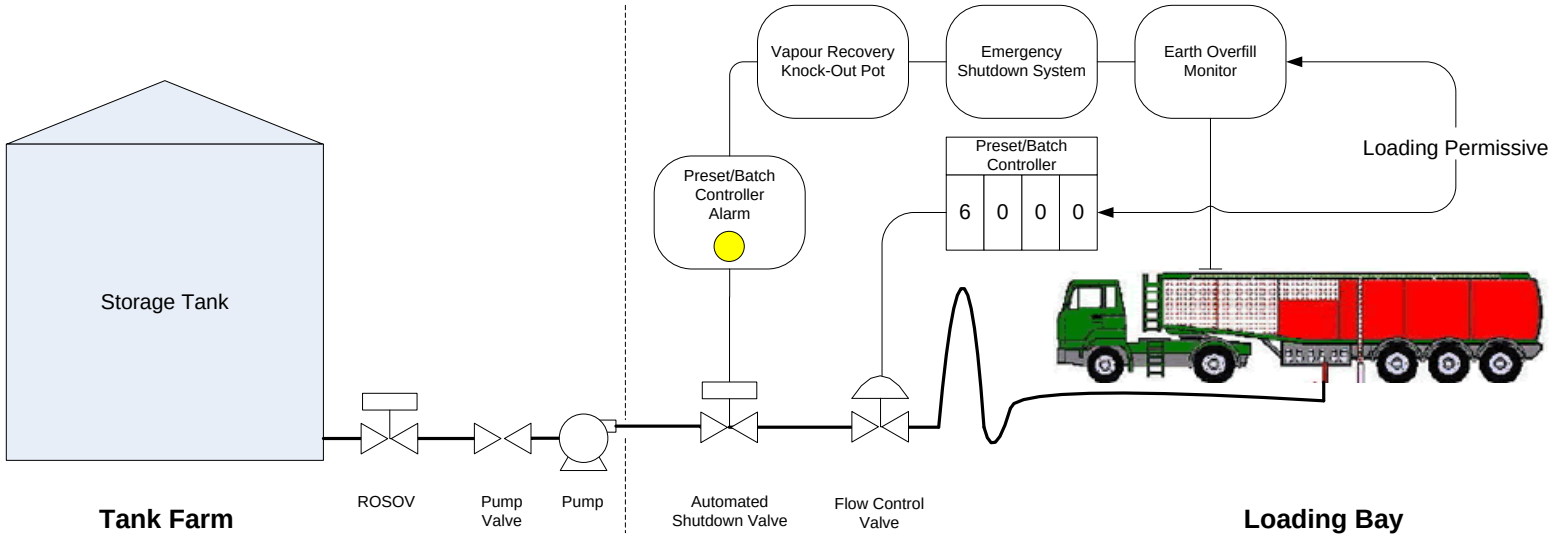
- A number of petrol spillages occurred during loading of road tankers from 2004 to 2009.
- Following an incident (2500 litre spillage) in July 2009, the incident was reviewed by UKPIA and Tank Storage Association committees and the root causes identified. Two Working Groups were formed under the Chemicals and Downstream Oil Industry Forum (CDOIF):
    1. Architectures of overfill prevention systems at terminal loading racks
    2. Hazard awareness during tanker loading operations
- Three key areas were studied:
    1. Causes of overfills
    2. Risk assessment
    3. System design and operation
    - Causes of overfills:
    1. filling a compartment that already contains gasoline (the driver is unaware)
    2. filling the wrong compartment
    3. failure of equipment intended to automatically stop gasoline flow
- Regardless of the cause, the overfill prevention system should, so far as is reasonably practicable, be able to stop the flow of product into the compartment before loss of containment occurs.
- Guidance on both topics, supported by the UK competent authority, was published in March 2011[1].

1. Copies of the guidance are available at http://www.hse.gov.uk/comah/guideline-terminal-loading-operations-hazard-awareness.pdf and http://www.hse.gov.uk/comah/guideline-terminal-loading-operations-hazard-awareness.pdf.

Overfill protection - system design and operation

- Is the flow control valve, and any associated pilot valves, correctly specified for the function it is expected to perform?
- In the event of failure of the flow control valve, is there an automated shutdown valve to stop gasoline flow? Is an automated shutdown valve triggered in response to identified faults/failures?
- Is an automated shutdown valve able to prevent or mitigate against overfilling of a road tanker, taking into account realistic scenarios?
- Are automated shutdown valves tested at a suitable frequency, according to specific criteria; are they maintained according to appropriate instructions?
- Are indications of failures recorded and assessed, and actions to address these taken?

An example of overfill prevention system architecture



Hazard awareness – key conclusions

- Consider the equipment necessary to aid responding to failures during loading operations:
  - ESD activation points should be positioned and signed appropriately, connected to the overfill prevention system.
  - Install audible/visual alarms activated on initiation of the ESD, CCTV, with images fed to the Central Control Room (CCR) and a loudspeaker system at each loading racks allowing two way communication with the CCR.
- Develop and deliver appropriate training, maintain competency and monitor performance
- Human factors , and what to do if loss of containment does occur:
  - Promote a 'no blame culture' for initiation of ESD. In the event of an overfill personnel should leave the risk area, and not return until it is safe to do so – this is the 'right' thing to do.
  - No expectation that the driver is to attempt to stop flow other than to initiate an ESD and inform the CCR. ESD initiations will be investigated with a view to identifying ways for improving the system.
  - Simple signage on what to do if a hazard is detected or suspected.
- Clear signage on the actions to take on detection of overfill may be a useful aid in raising hazard awareness with drivers, contractors and distribution terminal staff. For example:
  - Activate ESD
  - Notify other personnel in the area
  - Evacuate the area
  - Notify the control room
  - Await further instruction

Competency management systems - background

- A cross-sector industry group, the Process Safety Forum (PSF), was formed in 2008 in response to the Buncefield MIIB Recommendation 25:

  "In particular the sector should draw together current knowledge of major hazard events, failure histories of safety and environmental protection critical elements, and developments in new knowledge and innovation to continuously improve the control of risks..."

- The PSF initially included representatives from the chemicals, nuclear, power generation and distribution, rail and upstream and downstream oil sectors, but has now been expanded to include other sectors (e.g. engineering construction, explosives).

- A PSF review of the report into the Nimrod disaster (Afghanistan, 2006)[1] highlighted key failures:

  1. Safety Case regime ineffectual
  2. Inadequate consideration for the needs of aged aircraft
  3. Personnel weaknesses
  4. Unacceptable procurement process
  5. Poor safety culture

The review identified two key areas of concern applicable for the upstream and downstream oil sectors:

- Competency management systems
- Procurement systems

1. See http://www.official-documents.gov.uk/document/hc0809/hc10/1025/1025.pdf.

Competency management systems

Competence (or competency) is the ability of an individual to do a job properly. It is described as a combination of knowledge, skills and behaviour required to perform a specific role.

- Guidance on Competency Management Systems has been developed through a joint initiative by UKPIA and COGENT, the UK Sector Skills Council for the chemicals, pharmaceuticals, nuclear, oil and gas, petroleum and polymer industries[1].
- Key principles of competence assurance and the competence management process were identified:
    1. Demonstrating leadership and commitment
    2. Identifying business critical activities pertaining to the control of major accident hazards
    3. Setting procedures and standards
    4. Compliance against your standards
    5. Taking actions to improve competence
    6. Commitment to continuous improvement
- The purpose of a competence management system is to control, in a logical and integrated manner, a cycle of activities that will assure competent performance.
- The aim is to ensure that individuals are clear about the performance expected of them, that they have received appropriate training, development assessment and re-assessment; and that they maintain or improve their competence over time.

1. See http://www.cogent-ssc.com.

Competency management systems - guidance

- The guidance[1] describes six steps to implementation of a Competency Management System (CMS) aligned to the six key principles:
  1. Define the scope
  2. Design the CMS
  3. Implement the CMS
  4. Assess and maintain
  5. Verify and audit
  6. Apply the guidance to the contractor workforce

- Focus on safety critical tasks – those that if not performed correctly could contribute to a major accident hazard.
- UKPIA has developed a self-assessment module for Competency Management. A UK HSE Delivery Guide[2] on Competency Management is also available – the UKPIA self-assessment tool cross references HSE principles with CMS guidelines.
- The Cogent guidance and UKPIA self-assessment tool has proved invaluable to UKPIA member companies in identifying competency improvement requirements.

1. See http://www.cogent-ssc.com/Publications/CMS_Web_Version.pdf.
2. This provides guidance to regulators on how to assess competency management systems, see http://www.hse.gov.uk/comah/guidance/inspection-competence-management-systems.pdf.

Additional information

More information on UKPIA's commitment to process safety, self assessment tools, CDOIF guidance, and safety alerts issued by the process safety forum can be found on the UKPIA website www.ukpia.com.

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