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Fire and Rescue Authorities Operational Guidance

GRAs

generic risk assessments

GRA 3.10

Fighting fires in petrochemical
plant and pipelines

Generic Risk Assessment 3.10

Fighting fires in petrochemical plant and pipelines

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SECTION 1

Generic Risk Assessment 3.10 Fighting fires in petrochemical plant and pipelines

Scope

This generic risk assessment applies to all Fire and Rescue Authority operations which involve petrochemicals and their derivatives.

The purpose of this assessment is not to address every conceivable hazard that may be presented, but to identify, evaluate and control the 'significant risks' which are specifically inherent with these particular incidents.

The assessment is particular to firefighting, rescue or other operations, at locations where petrochemicals are processed or stored and include:

- oil refineries and other processing installations
- storage tanks of various types
- tank farms
- road tankers and rail cars
- pipelines.

(This list is not exhaustive)

This, as for all generic risk assessments, provides a starting point for Fire and Rescue Authorities to conduct their own assessments within the context of local conditions and existing organisational arrangements.

Persons at risk

All fire and rescue personnel in attendance at such incidents may be exposed to risk.

In addition, the health, safety and welfare of all non-service personnel may also need consideration. In particular:

- members of other emergency response services
- personnel of the affected site/contractors
- civilian specialists
- members of the media
- members of the public in the vicinity of the incident.

This generic risk assessment will be reviewed for its currency and accuracy three years from date of publication. The Operational Guidance Strategy Board will be responsible for commissioning the review and any decision for revision or amendment.

The Operational Guidance Strategy Board may decide that a full or partial review is required within this period.

Significant hazards and risks

The significant hazards that may be present, depending upon specific scene scenario and conditions can include:

Explosion hazard

Hazardous chemical substances which are not designated specifically as explosives may present an explosion hazard in the following circumstances:

UNCONFINED VAPOUR/GAS CLOUD EXPLOSIONS

Large quantities of flammable gases or vapours in open air which are ignited may cause deflagration with pressure waves or less commonly supersonic (detonation) advancement of flame fronts (ie ethylene vapour cloud).

CONFINED VAPOUR CLOUD EXPLOSIONS

Flammable substances igniting within a container (eg process vessel) which generate pressure build up and detonation velocities (ie natural gas explosions).

BOILING LIQUID EXPANDING VAPOUR EXPLOSIONS

Caused by failure of pressure vessels containing volatile flammable liquid and/or gases involved in fire.

STEAM EXPLOSIONS

Boil over or froth (Slop) over in oil storage tanks.

DEMOLITION/REPAIR OF TANKS

An explosion hazard may exist to personnel from 'empty' tanks which may contain an explosive mixture within the tank due to the emission of flammable vapours when the sludge or residual contents are heated ie from repair work, demolition, or radiated heat from a nearby fire.

Flammable substances

CLASSIFICATION OF PETROLEUM OILS

Petroleum oils are classified according to their flash points. Flash points are a guide to the relative volatility (volatility – the tendency of a liquid to vaporise) and give an indication of their behaviour when heated. Flammable liquids with a high volatility generally have low flash points and are more hazardous than flammable liquids with a low volatility, which generally have higher flash points.

The classifications are:

CLASS 'A'

Light fractions with a flash point below 22°C eg crude petroleum, benzene, petrol, liquefied petroleum gas, toluene, xylene, liquefied natural gas, hexane. All of this group are highly volatile and will form explosive mixtures in air/oxygen.

CLASS 'B'

Medium oils which have a flash point between 22°C and 60°C

Structural collapse

At hydrocarbon and gas producing plants much of the construction is in the form of unprotected steelwork. There is a significant hazard of structural collapse in fire situations.

Slop over and boil over hazard

Thermal effects on the stored products can produce a number of hazardous conditions ranging from slop over conditions due to thermal expansion or surface boiling of product to the potentially deadly boil over where a heat wave is produced in the product itself which then travels downwards from the burning surface at a rate of between 380-500mm per hour and this wave may reach temperatures of 300°C which is well above the boiling point of water. When this heat wave reaches the residual water in the bottom of a tank it causes it to turn to steam at an expansion ratio of 1700:1 which in turn causes burning oil (combined with steam) to be ejected from the tank in a violent manner. The potential spread of such an occurrence could exceed up to four tank diameters.

Toxic/poisonous substances

Hazardous chemical substances range in their human toxicity effects from being minor toxins with reversible effects to extremely harmful toxins that cause permanent human cell damage.

The predominant health effects of hazardous chemicals are classified as:

- harmful
- irritant
- sensitising
- corrosive
- toxic
- very toxic
- carcinogen
- mutagenic (causing cell mutation in the person exposed)
- teratogenic (toxicity affects human reproduction).

In addition to the toxic and carcinogenic hazards of most petroleum products, significant toxic/poisonous hazards exist to personnel from substances used/stored in the various processes at oil refineries ie chlorine, hydrogen sulphide and sulphur dioxide.

The products of combustion from incidents of this type are also hazardous to health.

Corrosives

Corrosive and irritant substances produce local ill health effects at the site of exposure. This can range from a mild dermatitis type condition to severe tissue damage. There are a number of substances present in petroleum producing plants that carry this hazard.

Asphyxiates

Inert or certain flammable gases may cause oxygen deficiency in the atmosphere. The greatest hazard is usually presented in enclosed or low-lying areas.

Impact injury hazard

Explosive combustion may present a risk of impact injuries from projectiles. Hazards from moving plant, machinery and traffic will also exist in these instances.

Drowning hazard

Presented when operations involve work near to open vats, tanks, pits, bunds and other storage vessels containing liquids or perhaps finely divided solids particularly during and post firefighting operations.

Confined spaces

Confined spaces are present throughout petrochemical production and storage areas. These will compound the generic risks found in such plant and their particular hazards are detailed in a separate risk assessment and in the *Working in Confined Spaces Regulations, 1997*.

Excessive heat and or humidity

This may occur due to the elevated temperatures present in the processing of petrochemical products or from the effects of fire and the products of combustion.

The potential for excessive body core temperature rises also exists due to a combination of a demanding and strenuous workload and the level of personal protective equipment being worn.

A risk of burns/scalds exists to personnel from steam and other hot pipes. The hazard increases near tanks of bitumen and heavy oils as steam coils are used to keep these substances fluid enough to be pumped

Cryogenics

A risk of cold burns of lowered body temperatures to personnel may be presented by bulk releases of liquefied gases and or other products stored under refrigerated pressure storage. Reference should be made to additional personal protection with regard to thermal protection.

High pressures

Lighter petroleum products, ie liquefied petroleum gases, are stored under high pressures in a variety of storage vessels in order to maintain these gases in a liquid state. Equally, the associated pipe work and pipelines used to service such production and storage carry the same risk.

Noise

Transmitted from high-pressure gas releases, explosive decomposition, mechanical equipment and toxic alarms.

Electricity

Static electricity and electrical sparks can ignite escaping vapours from petroleum products.

A risk of electrocution or ignition of flammable substances may be presented by both integral site and vehicle electrical systems, hazards associated with overhead lines and sub-surface supplies must also be considered. Further, oil refineries and similar premises usually have their own electrical substation on-site that in itself may create its own inherent risk.

Meteorological conditions

The ability to safely approach and manage the incident can be seriously affected by wind strength and direction, precipitation, ambient temperature and time of day.

Key control measures

Planning

Planning is key to enhancing the safety of firefighters and others likely to be affected by Fire and Rescue Authority operations. Each Fire and Rescue Authority's strategic plans will set standards and identify the resources required to ensure safe systems of work are maintained.

Each Fire and Rescue Authority must assess the hazards and risks in their area relating to this generic risk assessment. The assessment must include other Fire and Rescue Authority's areas where 'cross border' arrangements make this appropriate.

Site-specific plans and site pre-plans for identified hazards must be considered for locations where the hazards and risks are significant and plans must take into account and specify any variation from the normal operational capability of personnel, appliances and equipment. In particular, recognition must be given to the physical and psychological pressures that an operational incident may have on fire and rescue personnel.

Site-specific plans must include:

- levels of response

- relevant standard operating procedures
- tactical considerations, including rendezvous points, appliance marshalling areas and access points
- identification and where necessary, the formal notification to person(s) responsible for the site of any Fire and Rescue Authority operational limitations.

Planning is underpinned by information gathering, much of which will be gained through inspections or visits by fire and rescue personnel – for example, those covered by section 7(2)d and 9(3)d of the *Fire and Rescue Services Act 2004*.

Information must also be gathered and used to review safe systems of work from sources both within and outside the Fire and Rescue Authority, including:

- fire safety audits
- incident de-briefs
- health and safety events
- local authorities
- local resilience fora.

Involving others in planning is an effective way to build good working relations with partner agencies and other interested parties, such as site owners.

Fire and Rescue Authorities must ensure systems are in place to record and regularly review and audit risk information to ensure that new risks are identified and recorded as soon as practicable.

Fire and Rescue Authorities must ensure that the information gathered is treated as confidential, unless disclosure is made in the course of duty or is required for legal reasons.

Fire and Rescue Authorities must consider the benefits of using consistent systems and formats to record information from all sources. Consideration must also be given to how timely access will be provided to inform and support operational decision-making.

Information needs will vary in proportion to the size and nature of the incident. The capacity of fire and rescue personnel to assimilate information will vary in relation to the complexity of the incident. Therefore, arrangements may need to be flexible and be based on more than one system.

Further guidance on planning can be found in the *Fire and Rescue Service Operational guidance – Operational risk information* and any other relevant sources.

<https://www.gov.uk/government/publications>

Competence and training

When formulating a competence and training strategy, Fire and Rescue Authorities must consider the following points:

- Ensure specific risk assessments for this incident type are suitable and sufficient and that those tasked with carrying out the assessment and developing procedures are competent to do so
- Fire and Rescue Authorities must ensure that their personnel are adequately trained to deal with hazards and risks associated with generic risk assessment
- The level and nature of training undertaken must be shaped by an informed training needs analysis that takes account of Fire and Rescue Authority guidance on the competency framework, national occupational standards and any individual training needs.

Training and development programmes must:

- Follow the principles set out in national guidance documents
- Be structured so that they move from simple to more complex tasks and from lower to higher levels of risk and typically cover standard operational procedures as well as ensuring knowledge and understanding of equipment and the associated skills that will be required to use it
- Consider the need for appropriate levels of assessment and provide for continuous professional development, to ensure maintenance of skills and to update personnel whenever there are changes to procedure, equipment, etc
- Involve personnel involved in other processes that support the emergency response, such as planners devising procedures and people procuring equipment.

Specific training requirements for incidents involving petrochemical plant and pipework will include the standard operating procedure and the equipment to be used.

Training outcomes must be evaluated to ensure that the training provided is effective, current and it meets defined operational needs as determined by the Fire and Rescue Authority's integrated risk management plan.

Site-specific tactical exercises must be undertaken with other agencies or staff likely to assist at an actual incident.

Command and control

The Incident Commander must follow the principles of the current national incident command system. Prior to committing personnel into any hazard area, the Incident Commander must take account of the actual information about the incident that is available to make operational decisions in what are recognised as sometimes dangerous, fast moving and emotionally charged environments.

Communication of new or changed risks must continue throughout the incident.

Operational considerations

EXPLOSION HAZARD

- locate appliances at a safe distance away from the risk
- protect surrounding area with cooling sprays where ignition has occurred

- use site-specific risk information and or standard operating procedures as appropriate
- establish a restricted area
- minimum number of personnel within hazardous areas for safety critical tasks, following a risk based approach
- use of intrinsically safe equipment
- liaise with on-site specialist adviser
- establish a restricted area, utilising police assistance to close roads, crowd control etc.

IRRESPIRABLE/FLAMMABLE/ASPHYXIANT ATMOSPHERES

- where the atmospheric conditions are unknown or are believed to be irrespirable, breathing apparatus must be used
- breathing apparatus crews must receive specific briefings on the hazard and any emergency procedures for evacuation
- atmospheric monitoring equipment, if available, must be carried by personnel in the risk area
- seek the advice from the site engineer to ascertain if mechanical ventilations systems can be used to clear the effected area
- isolate the source of the irrespirable/flammable atmosphere ie turn off cylinders or mains supplies following advice from site specialists, in remote areas seek advice from pipeline managers
- minimum number of personnel within hazardous areas for safety critical tasks, following a risk based approach
- where safe to do so isolate all ignition sources
- rescue teams to be deployed with suitable and sufficient firefighting means
- provide covering jets for firefighting purposes
- establish a restricted area, utilising police assistance to close roads, crowd control etc.

STRUCTURAL COLLAPSE

- cool structure to protect structural stability
- consider temporary structures eg scaffolding
- establish a restricted area, utilising police assistance to close roads, crowd control etc
- minimum number of personnel within hazardous areas for safety critical tasks, following a risk based approach.

'SLOP OVER AND BOIL OVER' HAZARD

- withdraw personnel to an identified safe area

- layout hose line to extinguish burning oil within the banded areas with foam
- appoint a safety officer/team to watch out for signs of slop over/boil-over
- establish a restricted area
- minimum number of personnel within hazardous areas for safety critical tasks, following a risk based approach
- establish a restricted area, utilising police assistance to close roads, crowd control etc.

CORROSIVES/ CRYOGENICS

- where available use appropriate personal protective equipment considering additional personal protection codes
- seek the advice of on-site specialists.

DROWNING HAZARD

- Fire and rescue personnel to be aware of the contents of *Generic Risk Assessment 2.4 – Rescues – Flooding and water safety*
- Fire and Rescue Authorities to have a standard operating procedure for working on or near water and all personnel to receive training in its implementation.

CONFINED SPACES

- A safe system of work must be established for personnel entering the confined space. Utilise appropriate breathing apparatus procedures. Consider the use of guide-line and branch-line tallies to identify multiple teams
- Keep crew sizes to a minimum
- Minimize exposure time for crews within the confined space
- Reliefs may have to be on a one team out one team in approach dependant on access and egress and working conditions
- Any equipment taken into or used in a confined space must be appropriate to the risk, suitable for the task, and mitigate further risks
- Lighting must be suitable and safe for the environment in which it is intended to be used.

Fire and rescue personnel must familiarise themselves with the contents of the *Generic Risk Assessment 2.1- Rescues – From confined spaces*.

NOISE

- permit a minimum number of personnel within hazardous areas for safety critical tasks, following a risk based approach
- where deemed necessary, use suitable ear protection
- radio communications to be used with an ear piece system if available.

ELECTRICITY

- Seek the advice of the site engineer if available

- Isolate power supplies where safe to do so
- Use insulated tools/gloves when working on electrical equipment
- Fire and rescue personnel to be aware of the contents of *Generic Risk Assessment 5.1 – Generic hazards – Electricity*.

RESCUES

Rescue operations must be the systematic application of planned procedures and control measures.

The following must be considered by the Incident Commander when carrying out rescues:

- Where hazardous substances such as, liquefied petroleum gas, electricity, cylinders, height and biohazards are involved the relevant risk assessment/ standard operating procedure must be considered
- Implement decontamination measures as required
- Minimum number of personnel to achieve the task must be deployed
- All deployed personnel to be given as much information as possible
- Personal protective equipment must be worn by all personnel and any additional protection, according to the hazardous nature of the substances involved
- Delegation of a dedicated Safety Officer or team
- Effective communications must be established and maintained
- Access and egress must be maintained at all times
- Suitable lighting must be considered to facilitate operations in poor visibility or at night, particularly for access/egress during rescue operations and any high-risk areas. However, in non-fire incidents of flammable vapour release the use of lighting may be restricted or prohibited unless suitable atmospheric monitoring has taken place
- Consider the use of thermal image cameras
- Protection from radiated heat for deployed rescue personnel must be considered
- In the case of rescues from within bunded areas the following additional points must be considered:
 - depth of liquid in bund may hamper rescue operations
 - foam may be applied as a protective blanket, however, consider the possibility of re-ignition
 - a spray must be available for immediate use to protect deployed personnel and for possible emergency decontamination of casualty
 - identification of the liquid must be made and personal protective equipment worn, specialist advice must be sought

- extinguish all naked lights
- provide medical assistance for casualties.

Firefighting

GENERAL

The Incident Commander must consider the following control measures:

- Locate appliances in a safe area, upwind when applicable
- Liaise with local expert/site personnel for advice and information
- Immediate establishment of a restricted area, the size of which being determined by the incident conditions
- Consider police assistance for road closure and cordon control
- Prevent fire spread by cooling nearby structures, buildings, pipelines etc or use a good foam wall. The use of monitors and suitable aerial appliances for water curtains/foam laying must be considered
- Minimum number of personnel must be deployed to achieve operational tasks, with remaining personnel withdrawn to safe area
- Effective communications must be established and maintained with all sectors officers
- The prevention of flammable liquids entering public drains etc must be carried out, and the appropriate authority/body informed if drains have been affected.

OIL REFINERIES/TANK FARMS

At fires involving oil refineries/tank farms the Incident Commander must consider the following points:

- Liaise with refinery specialist/fire officer for technical advice etc
- Consideration must be given to realistic timescales required to acquire sufficient foam concentrate at the incident ground to enable effective firefighting
- Refinery firefighting personnel may have initiated some form of action. The Incident Commander must ensure the coordination of joint operations
- Prevent fire spread by cooling nearby structures, etc
- Use fixed water protection systems, ie tank drencher systems or fixed/mobile site monitors
- Drains provide a means for spreading a flammable liquid fire but at large sites they may also be a means for the removal of fuel to a catchment area if there is no fire situation
- Prevent fire spread by laying a foam blanket over un-ignited pools of oil
- Foam may be required in large amounts before a sustained foam attack can be initiated, consider the mutual aid scheme and sites foam supplies and equipment

- In addition to ring mains other water supplies may be available either from static tanks with hard standing, or open water supplies with access at jetties
- Consider the elimination of fuel supplies by closing valves, re-routing flow elsewhere, depressurising systems or pumping out tanks, all of which must be carried out by refinery personnel as far as possible
- Consider the water run-off from cooling or firefighting operations, it may contain floating oil and cause fire spread.

PROCESS UNIT FIRES

- Extinguished principally by fuel removal and upon refinery operatives being able to reduce pressure, introduce steam or nitrogen and to depressurise part or all of the unit involved
- Cool surrounding areas and structures and structure of vessel involved
- Cooling water can cause contraction of flanges and joints to leak so very fine sprays must be used
- If incidents are at a height ie tower structures, a jet may be required. This must converge with other jets so the spray produced can be directed where required. Jets must not be played directly at structures
- Apply foam blanket to pools of unignited flammable liquids to prevent flashback and reduce fire spread
- Safety Officer/team must be delegated where structural collapse or observance of teams in high hazard areas is required.

FIXED ROOF TANK FIRES

- On tanks from which the roof has blown or on which a seam has opened, foam must be used
- Operate fixed foam facilities if available
- Protect tank shell with cooling water at a time agreed prior to foam application following advice from site specialists
- Use fixed chambers or risers on tanks but if none available consider the use of a suitable arial appliance to discharge foam over the rim
- Prioritise and protect adjacent tanks from radiant heat, especially any tanks downwind of incident
- Extinguish fires burning outside the tank to avoid heat impinging on tank shells.

FLOATING ROOF TANKS (OPEN AND COVERED)

The Incident Commander must consider the following points:

- In open floating roof tanks there is no vapour space beneath the floating roof the chance of explosion is virtually nil, unless the roof is standing on the jacks and there is a vapour space beneath it. In this case the procedure, as for fixed roof fires, must be considered

- Covered floating roof tanks may have a vapour space between the floating roof and the fixed roof
- Small seal fires are usually extinguished by fixed installations but re-ignition may occur due to the heated metal
- A very fine water spray can be used to avoid re-ignition, and possibly extinguish the fire itself taking care not to use too much water or heavy streams which may increase the fire hazard
- At larger rim fires the use of foam can be used to extinguish the fire. Consider the use of fixed risers for application
- Cooling of adjacent structures, etc must be initiated where applicable
- The cooling of the tank shell must be initiated, particularly where blistering paintwork can be seen
- Should the floating roof have been displaced by explosion or fire, it must be tackled with foam as for a fire in an open tank.

SLOP-OVERS

The Incident Commander must consider that a slop-over is imminent when the smoke at the tank top windward side is lighter in colour due to the formation of steam and a sizzling sound is heard.

The Incident Commander must consider the following control measures if a slop-over is going to occur, namely:

- inform all sector officers to withdraw personnel
- withdraw all personnel to a safe distance
- lay out hose-lines to extinguish burning oil within the bunded areas with foam.

BOIL-OVERS

The Incident Commander must consider that a boil-over can only occur with oils containing widely differing gravities and boiling points, ie some crudes and unrefined oil, which can produce a heat wave. Distilled oils, ie petrol, kerosene, diesel and lubricating oils with their narrower boiling points and lack of impurities do not produce a heat wave.

The Incident Commander must consider the following in relation to boil-overs:

- Heat waves travel downwards at a rate of approximately 375 - 475 mm per hour at a temperature of up to 250°C - 300°C. (well above the boiling point of water)
- Water turns to steam at a rate of 1700:1 therefore 1 litre of water when flashed to steam may produce up to 1700 litres of froth
- Burning oil can be thrown out beyond the bunded area which may amount to several hundred tons if the tank is large
- Tank water gauges will confirm if and approximately when a boil-over is expected
- Liaise with site personnel to explore means of draining water from tank

- A dedicated Safety Officer/team must be delegated to watch out for signs of boil-over:
 - similar signs as for a slop-over but with a marked heightening and brightening of flames for a few minutes before the boil-over occurs.
- A heat waves progress can be determined by temperature paint on tank or water applied to tank shell or wavy appearance of air adjacent to the shell. Consider the use of thermal image cameras and laser thermometers
- The Incident Commander must withdraw all personnel if extinguishment has failed by the time the heat wave has reached 1.5m above a known bottom water level
- A roll call must be made to ensure that the area has been evacuated
- More than one boil-over can occur at any incident.

TANKS UNDER REPAIR/DEMOLITION

The Incident Commander must bear in mind that any fire within a tank under repair or demolition is extremely hazardous and assume it may explode, unless the top or end of the tank has been previously removed. Structural integrity may also be compromised.

The Incident Commander must consider the following control measures:

- Liaise with site personnel for information and technical advice
- Protect persons in the area and establish a restricted zone
- No personnel to be allowed on top of or inside a tank unless for rescue purposes
- The Incident Commander must perform a suitable and sufficient risk assessment in order to decide upon deployment for rescue purposes
- All personnel entering a tank for rescue purposes must wear personal protective equipment as identified by the risk assessment.
- Minimum number of personnel must be deployed ensuring suitable access and egress are available at all times.
- Emergency teams must be established prior to deployment and access made as close to the location of casualties as possible
- No personnel to be allowed on top of adjacent tank roofs unless it is essential for operational reasons
- No attempt to open or close inspection covers or other fitments must be made by Fire and rescue personnel as this may adversely affect tank atmosphere
- Most fires in tanks under repair/demolition are normally left to burn notwithstanding the possibility of an explosion
- Protect surrounding structures from radiated heat etc with cooling sprays
- If purging is being used by works personnel then this must be maintained/increased but if fire is not extinguished, then allow to burn out

- If access is identified and the fire is low down in the tank then foam can be used to extinguish the fire. Assessment of fire location will involve risk and must be done from a distance.

SPILL FIRES

- All leaks must be isolated in consultation with on-site specialist personnel. Valving-down procedures must be followed
- Lay foam blanket over spill to prevent re-ignition and reduce fire spread
- Protect surrounding risks with water sprays
- Starting at the farthest point of fire and working towards the source a foam blanket must be applied gently to any flammable liquid
- The use of sand banks, earth etc can be used to contain or redirect spills
- Certain products burn with a clear flame which is difficult to see in bright sunlight. Thermal image cameras must be used to detect the extent of the flame fronts in the first instance. Should flames be detected, the use of police aerial support must be considered.

ROAD TANKERS AND RAIL CARS

The Incident Commander must consider the following points:

- locate appliance in a safe area, upwind if possible and establish a restricted area
- consider evacuating any nearby premises to a safe, upwind area
- use minimum number of personnel within hazardous areas
- filling/emptying operations must be stopped and fuel valves closed following specialist advice
- water sprays used to cool tanker must be maintained after flame extinguishment to prevent re-ignition from hot metal surfaces
- protect surrounding property/area, tankers etc with water sprays
- when a closed tank is burning at the vent or filling valve, rapid extinction of the flame with foam must be considered due to possible ignition of the tanks vapour space
- where possible, sources of ignition must be removed from the vicinity to prevent re-ignition
- low lying areas in the vicinity must be considered hazardous as they may contain flammable vapour.

PIPELINES

Operators who use pipelines to transport hazardous materials must apply the conditions imposed by current Pipeline Safety Regulations.

When dealing with fires the following points must be taken into consideration:

- Valves on pipelines must only be closed following close consultation with on-site specialists
- The area must be cordoned off
- Initially fires must not be extinguished until agreement has been made between on-site specialists and the Fire and Rescue Authority. Adjacent areas must be protected and cooling sprays or curtain sprays must be used to maintain the pipelines integrity
- Be aware of low lying areas, ie ditches river/stream gullies etc, as some vapours are heavier than air and may accumulate in these areas creating a flammable risk
- Consider the reaction of firefighting media with substances
- Implement control measures to prevent liquid leaks from entering drains and watercourses.

Safety Officer(s)

The early appointment of one or more 'Safety Officer' will assist in supporting a tactical plan to address risks so they can be eliminated or reduced to an acceptable level.

A safety decision-making model must be used to brief Safety Officers regarding the nature of the incident, the allocated task and prevailing hazards and risks. The Incident Commander must confirm that the Safety Officer understands:

- their role and area of responsibility
- allocated tasks
- lines of communication.

Those undertaking the Safety Officer role must:

- be competent to perform the role
- ensure personnel are wearing appropriate personal protective equipment
- monitor the physical condition of personnel and/or general or specific safety conditions at the incident, in accordance with their brief
- take any urgent corrective action required to ensure safety of personnel
- update the Incident Commander or senior safety officer regarding any change in circumstances
- not be engaged in any other aspect of operations, unless this is required to deal with a risk critical situation.

The role of a Safety Officer can be carried out by any of the fire service roles, but the complexity of the task, size of the incident and scope of responsibility must be considered by the Incident Commander when determining the supervisory level required.

Safety Officers must wear nationally recognised identification to indicate that they are undertaking the 'Safety Officer' role.

Fire and Rescue Authorities must ensure that training and other measures (such as aide memoires) are in place and available to support those staff liable to undertake this role.

Specific safety considerations

- At tank fires personnel must not be deployed onto the roof of a tank unless absolutely necessary, ie rescues, and then only with adequate control measures implemented (emergency breathing apparatus teams, water spray protection and egress route maintenance)
- In any situation involving flammable liquids/vapours etc all access/egress must be monitored and maintained due to the rapid fire propagation characteristics of these substances. Personnel in high hazard areas must be assigned a dedicated observer/safety officer
- The characteristics of vapour clouds must be considered
- Appropriate lighting of the area must be carried out to facilitate operations, particularly at night or poor visibility, taking into consideration the effects of non-intrinsic equipment and unignited flammable gas/vapours etc
- Items that may present an ignition source must be carefully managed at incidents involving flammable substances.

Personal protective equipment

Fire and Rescue Authorities must ensure that any personal protective equipment provided is fit for purpose and meets all required safety standards. When choosing suitable protective garments, the standard of clothing worn beneath the specialist personal protective equipment must also be taken into account. Consideration must also be given to the selection of suitable sizes and gender specific requirements of personal protective equipment.

Personal protective equipment must also take account of the need for rescuers to be visible against the operational background including night working and for the Incident Commander and other managerial and functional roles (defined in the national incident command system) to be distinguishable.

All personnel must use appropriate levels of service provided personal protective equipment and respiratory protective equipment as determined by the safe system of work.

Post-incident

The following measures must be considered to help eliminate or remove risks after an incident, as appropriate to the nature and scale of the incident:

- Any safety events; personal injuries, exposure to hazardous substances or near misses must be recorded, investigated and reported in line with legislative requirements such as *Reporting of Injuries Diseases and Dangerous Occurrence Regulations 1995 as amended*

- Arrangements must be in place to either remove all contamination from personal protective equipment or to ensure it's safe and appropriate disposal and to check that personal protective equipment maintains the agreed levels of integrity and protection for the wearer throughout it's lifecycle
- As appropriate, occupational health support and surveillance follow up
- Conduct a de-brief to identify and record any 'lessons learned' from the incident. De-briefs will range in complexity and formality, proportionate to the scale of the incident and in line with individual Fire and Rescue Authority's procedures
- Consider any changes required to safe systems of work, appliances or equipment in the light of any lessons learned from debriefs or from safety events
- Consider the need to review existing information held on a premises or location, or the need to add a new premises or location into future planning eg by adding to visit or inspection programme
- Personnel must be supported and monitored to identify whether they are experiencing any adverse affects and to check whether they would benefit from accessing counselling and support services.

Consideration must be given to arranging for staff to make a contemporaneous written record of their actions. This information may be used to assist in any internal or external investigations or enquiries that follow any incident eg Coroner's Court, public enquiry, etc.

Technical references	
1	Fire & Rescue Services Act 2004
2	Control of Major Accident Hazards Regs 1999 (COMAH)
3	Fire and Rescue Manual Vol. 2 Incident Command 3rd Ed 2008
4	Civil Contingencies Act 2005
5	Pollution Prevention Guidelines: PPG 18 Managing Fire Water and Major Spills
6	Meteorological Support for Incidents Involving Toxic Chemical (CHEMET) Chemsafe Scheme
7	Fire Service Manual Vol. 2 Fire Service Operations Petrochemical Incidents
8	Fire Service Manual Vol. 1 Fire Service Technology Equipment & Media FF Foam
9	Personal Protective Equipment at Work Regulations 1998

SECTION 2

Summary of Generic Risk Assessment 3.10

Fighting fires in petrochemical plant and pipelines

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
1	Working at height	Falls from height	Fatality Major injury Minor injury	Fire and rescue personnel Civilian specialists Works personnel	Incident Command Minimum personnel committed to achieve task Ensure and maintain site illumination Safe working at height equipment and trained personnel Available breathing apparatus equipment Consider aerial appliance for access Supervised entry point Consider on-site equipment / expertise.

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
2	Firefighting	Equipment falling from height	Fatality Major injury Minor injury	Fire and rescue personnel Civilian specialists Works personnel	Incident Command (safe system of work) Minimum appropriately trained crew levels at scene deployed Cordon and supervise adequate area below scene of operation (drop zone) Minimum crew briefed Secure large items of equipment to suitable anchor point when situated at height Items must be kept away from edge Equipment dump All personnel to wear personal protective equipment / safe working at height equipment Safety Officer.
3	Firefighting	Electrocution	Fatality Major injury Electrical burns	Fire and rescue personnel Civilian specialists Works personnel	Fire and Rescue Authority to: <ul style="list-style-type: none"> • carry out a risk assessment • consider method of electrical supply isolation • liaise with site specialist • use the correct personal protective equipment • use site specific risk information • brief crews on potential hazards.

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
4	Firefighting	Risk of burns/scalds from steam and other hot surfaces	Fatality Major injury Minor injury	Fire and rescue personnel Civilian specialists Works personnel	Fire and Rescue Authority to: <ul style="list-style-type: none"> • carry out a risk assessment • use the correct personal protective equipment • establish a restricted area • brief crews on potential hazards.
5	Firefighting	Risk of slop-overs and boil-overs from oil storage tanks	Fatality Major injury	Fire and rescue personnel Civilian specialists Works personnel	Fire and Rescue Authority to: <ul style="list-style-type: none"> • carry out a risk assessment • withdraw personnel • layout hose line to extinguish burning oil within the bounded areas with foam • appoint a safety officer/team to watch out for signs of boil-over • ensure the correct personal protective equipment is used • establish a restricted area.

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
6	Firefighting	Risk of structural collapse	Fatality Major injury	Fire and rescue personnel Civilian specialists Works personnel Public Other agencies	Fire and Rescue Authority to: <ul style="list-style-type: none"> • carry out a risk assessment • cool structure to protect structural stability • establish a restricted area, utilising police assistance to close roads, crowd control etc • ensure the correct personal protective equipment is used.

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
7	Firefighting and rescue operations	<p>Risk of heat and humidity</p> <p>Risk of explosions and collapsing structure</p> <p>Risk of contamination from hazardous substances</p> <p>Risk due to location and rescue of casualty</p> <p>Crew fatigue</p>	<p>Fatality</p> <p>Major injury</p>	<p>Fire and rescue personnel</p> <p>Civilian specialists</p> <p>Works personnel</p> <p>Public</p> <p>Other agencies</p>	<p>Fire and Rescue Authority to:</p> <ul style="list-style-type: none"> • carry out a risk assessment • to locate appliances in a safe area, upwind where applicable • liaise with local expert/site personnel for advice and information • use correct personal protective equipment • ensure effective communications are established and maintained with all fire exposures • appoint a Safety Officer • ensure access and egress routes are maintained • consider thermal image camera • implement decontamination measures if applicable. <p>Rotation of crews</p> <p>Welfare facilities / arrangements / hydration of crews</p> <p>Access to occupational health arrangements.</p>

Ref. No.	Activity	Hazard	Risk	Persons at risk	Control measures
8	Environmental protection	Risk of fuel, foam contaminated water Risk of toxic and or hazardous substances entering watercourse	Injury/illness caused by toxic and or hazardous materials	Fire and rescue personnel Civilian specialists Works personnel Public Other agencies	Fire and Rescue Authority to: <ul style="list-style-type: none"> endeavour to prevent fuel from entering drains, water courses, etc, and inform relevant authority (Environment Agency and local water undertaker) if it occurs consider using sand or earth barriers to bund/control leaks liaise with site specialist.