Control of Fire Water Run-Off

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1. PURPOSE

This guideline is provided to help operators of dangerous goods sites and major hazard facilities ensure they have adequate arrangements in place to deal with water and/or foam used to tackle spills or fight fire at their premises.

Large voulmes of water are used in fire fighting and, although some will turn to steam in the heat, much will fall to the ground and drain away from the site of the fire. Water or foam used to fight fires at premises where dangerous goods are present may become contaminated and hazardous. This means emergency preparedness and response plans must identify means of preventing liquid flowing with the topography and harming either people or the environment.

2. SCOPE

This guideline applies to all dangerous goods sites and major hazard facilities within the Metropolitan District that have obligations under the Dangerous Goods (Storage and Handling) Regulations 2012 and the Occupational Health and Safety Regulations 2017.

This guideline concerns the prevention of adverse health impacts and pollution damage resulting from the contamination of ground or surface water by fire water run-off.

This guideline does not specify how fires should be dealt with, or the extinguishing medium to use.

3. FIRE PREVENTION

Fire Rescue Victoria's (FRV) primary expectation of any operator of a dangerous goods site or major hazard facility is to prevent the outbreak of fire. Consideration should be given the prevention of ignition by, for example exercising proper control over maintenance activities, especially any involving hot-work. Suitable consideration should be given to electrical and heating services in the any area where dangerous goods are part of the fuel load.

Fire size can be restricted by limiting the fuel available, ensuring the segregation of incompatible substances, compartmentation of large inventories etc.

The earlier a fire can be tackled, the greater the chance of successfully extinguishing it and minimising the quantity of fire water requiring containment. A well designed active fire suppression system can be activated quickly and safely (i.e. remotely). This can reduce the amount of water needed to control or extinguish a fire, which in turn reduces the cost and scale of other facilities. The design of active fire-fighting systems should consider the potential for foam or fire water effluent to cause harm and contain it accordingly.

The water from sprinkler or deluge systems and any water applied by firefighters should be treated in the same way.

4. EMERGENCY PLANNING

Emergency plans at dangerous goods sites and major hazard facilities should consider the following:

- the scale of fire events requiring fire water or fire fighting foam to be deployed. Fire safety studies should inform design phase decisions and provide specific information in regard to the scale and likelihood of potential consequences. The required information can also be developed during an operations safety assessment. Well planned and organised emergency response measures significantly reduce the potential duration and extent of fire scenarios, and so reduce fire water volumes requiring containment and management

  Understanding the scale of potential fires allows for suitable provisions in terms of primary containment (e.g. tank type, dimensions), secondary containment (e.g. bunds, dump tanks) and tertiary containment (e.g. closed drains, sumps, diversion tanks, flexible booms)

- the potential for environmental damage from run-off taking into consideration the severity of the spill, the possible routes of contamination (ditches, drains etc.) and the sensitivity of the exposed flora and fauna (and its ability to recover if damaged)

Emergency information provided to FRV should include diagrams detailing the means by which spills of dangerous goods and fire water run-off are contained within the boundaries of the premises (site drains, stormwater grates, isolation valves and keys, sumps, interceptor pits etc.)

- waste management arrangements in order that any spillage, contaminated material or fire-fighting run-off can be safely disposed of as soon as possible.

5. CONTROL MEASURES

Where fire water run-off poses a threat to health or the environment, a means to minimise the risk must be implemented. There is no single correct means of control and FRV expects operators of dangerous goods sites and major hazard facilities to be able to demonstrate that they have implemented appropriate measures at their facility.

5.1. Secondary and tertiary containment facilities for fire water run-off include:

- impermeable bunds – facilities (walls and a base) constructed around an area where potentially flammable, harmful and or polluting materials are handled, processed or stored
- storage lagoons – excavated areas that are below the level of the surrounding area and able to retain liquids. Lagoons should be provided with an impermeable surface membrane to prevent pollutants soaking into the ground

  In circumstances where a bund or lagoon is lined with clay or other ‘substantially impermeable’ layer a ‘time to failure’ (based upon a maximum permeability – hydraulic conductivity – measured in ms^{-1}) should be determined in order that recovery actions can be planned to a timescale

- shut-off valves – means of closing drains or similar to stop flow

- isolation tanks – provide a relatively large storage volume in a small area, albeit at a financial cost. It may be possible to make use of a redundant or spare tanks
- modified areas of a site such as a hardstand car parking area
- pollution control equipment such as fire water booms and drain mats to block or divert run-off from drains, culverts etc.

5.2. The capacity of a containment system must be sufficient for the anticipated quantity of runoff from potential fires; this is difficult to calculate accurately but it should be estimated. Incident-specific determinations of this type should have regard to credible fire sizes and take account of the potential for fire spread (e.g. to buildings) as well as any fire detection or suppression system.

Tackling a small fire may require only a few tens of cubic metres of water whereas a large fire may require in excess of several thousand cubic metres of water.

5.3. In the event that a permanent containment system is sized to deal with the run-off from a 'small fire' the determination must be made that the installed system will provide sufficient time to put in place larger, temporary containment measures in the event of a 'major fire'.

In the event that a containment system is sized to cope with the run-off from a 'small fire' the temporary measures to control run-off in the event of a 'major fire' must be part of preparedness activities (i.e. included in pre-incident planning). This may involve but is not limited to:

- *sand, earth and proprietary absorbents – used to soak up spillages of oil and chemicals*
- *sealing devices and substances – pads, clamps and putties*
- *drain seals – for drainage grids or pipes. They must be kept in a readily accessible location; care must be exercised to avoid exposure to hazardous materials when installing seals*
- *booms – absorbent or plastic physical barriers, for use on watercourses to isolate drains or to divert or contain spillages.*

5.4. Where flammable or combustible liquids are held in multiple tanks in a common bund, FRV expects that the operators' emergency response plan shall be based upon a full understanding of the following:

a. the maximum volume of flammable and / or combustible liquids stored in each tank in the bund
b. the volume of the bund
c. the capacity of the of the bund expressed as a percentage of the capacity of (i) the largest tank; and (ii) the total capacity of all tanks within the bund
d. both the individual and cumulative flow rates of fire water into the bund from monitors, deluge systems etc.

The information reported for items 'a' to 'd' above should be reported using consistent units in order to facilitate on-scene decision making in the event of an emergency. It may be necessary to install fire water removal pipework or aqueous layer overflow to remote secondary or tertiary containment if the bund would fill within a short time frame.

e. a determination of the time taken to fill the bund after loss of containment of the largest tank (maximum fill) into the bund and application of the proposed fire/cooling water

f. the means by which the operator has determined that the bund can withstand the full hydrostatic head of liquid that may arise from the loss of primary containment

g. the means by which the operator has allowed for dynamic effects associated with the initial surge of liquid and for wind-blown waves in setting the height of the bund wall. In the absence of detailed analysis, FRV recommend an allowance of 250mm (more for earthen bunds)

h. the angle from the highest point on the closest part of the closest tank to the bund to the top (crest locus) of the bund. This is commonly defined as Tan θ and expressed as:

$$\frac{\text{Horizontal distance from top (crest) of bund to tank wall}}{\text{Vertical distance from top of bund to top of tank}}$$

This determination is made to assess the likelihood of bund ‘overtopping’ (liquid overflow) and becomes a significant concern when Tan θ < 0.5.

i. where the fire fighting strategy involves the use of fire fighting foam, the allowance made in the determination of the bund height for the foam layer. FRV recommend a freeboard of not less than 100mm.

5.5. Emergency preparedness involves establishing and maintaining measures that ensure the contents of a containment facility can be disposed of safely after an incident, without posing further risks to people or the environment. Where this involves using pumps to transfer run-off water, back-up power supplies should be identified in case normal power is interrupted as a result of an incident.

5.6. There may be cases, depending upon the location of the site, where it is appropriate to allow a fire to burn under control. This option may minimise the risk of a significant environmental incident but may cause other risks. There are a number of highly sensitive issues to consider and forward planning is essential. Decisions on controlled burning should be taken in consultation with relevant parties including, as a minimum; the fire authorities, Environmental Protection Authority Victoria (EPA), WorkSafe and local authorities. Factors to consider will include the effects on local populations, the risk of fire spreading and the impact from the smoke plume. It should be remembered that some application of water is likely to be required to ensure that the fire burns in a controlled manner and adequate provision should be made to contain run-off.

5.7. An **Emergency Plan** should consider fire-fighting strategies and possible methods of reducing the amount of run-off generated. Examples include the use of sprays rather than jets and the means of applying fire-fighting foam in order to minimise losses.

Foam logistics will make or break a fire attack on a storage tank – it is essential that the required tactics, flow rate (including losses) and duration are identified prior to the incident and that adequate supplies of foam are available.

5.8. In the event that an **Emergency Response Plan** relies upon the re-use of contained fire water run-off to tackle a fire, this should be discussed with FRV to determine any restrictions and whether there is a need for special equipment. It may also be necessary to arrange for the water to be monitored for its suitability in terms of health exposures and/or decontamination requirements for brigade appliances.

5.9. Relocation – in certain circumstances, especially in areas where there are significant threats to a unique or sensitive environment, relocation of any environmentally hazardous chemicals to an alternative site may be the most practicable solution.

Note: *this is a controlled document and may only be modified by authorised personnel after review by FRV Fire Safety Advisory Group.*