ENVIRONMENTAL ALLIANCE – WORKING TOGETHER

POLLUTION PREVENTION GUIDELINES

MANAGING FIRE WATER AND MAJOR SPILLAGES: PPG18

These guidance notes have been drawn up to assist in the identification of the equipment and techniques available to prevent and mitigate damage to the water environment caused by fires and major spillages. They are jointly produced by the Environment Agency for England and Wales, the Scottish Environment Protection Agency (SEPA) and the Environment and Heritage Service for Northern Ireland, referred to as the Agency or Agencies. Please contact your local Agency Office for further information. Contact details will be found at the end of these guidelines.

1. INTRODUCTION

a. The Agencies' guidance on industrial sites (PPG11-Reference 1) provides basic advice on pollution prevention. This guidance document gives examples of good practice for the protection of the environment in the management of run-off generated in the event of fire (or fire water) and major spillages. It aims to help site operators consider what is appropriate for a specific site, taking into account the risks and site layout. It is intended principally for those with responsibility for both new and existing, medium to large sites. However, much of the information will be relevant for smaller sites, especially those where high risk activities are carried out. It focuses on containment strategies, physical structures that can be used to contain firewater and spillages (so called "secondary containment" facilities) and equipment. Other approaches to protect the environment, such as operational and management controls, should also be considered. All of these measures, physical, operational and managerial should be supported by contingency or pollution incident response plans (see PPG21-Reference 2) to reduce the impact of any unplanned event that does occur.

b. Most industrial and commercial sites have the potential to cause significant environmental harm and to threaten water supplies and public health. Spillages of chemicals and oil are obvious threats. However, materials which are non-hazardous to humans, such as milk and beer, may also cause serious environmental problems, as can the run-off generated in the event of a fire. The environmental damage may be long term and, in the case of groundwater, may persist for decades or even longer. Rivers, sewers, culverts, drains, water distribution systems and other services all present routes for the conveyance of pollutants off-site and the effects of a discharge may be evident some distance away. In many cases, major pollution incidents can be prevented, if appropriate pollution prevention measures are in place or immediately available. Contingency planning is the key to success and both preventative measures and incident response strategies need to be carefully addressed. In the event of an incident the Agency must be contacted immediately.

c. Pollutants may escape from the site into the water environment by a number of pathways. These include:-

   i. the site's surface water drainage system, either directly or via off-site surface water sewers.

   ii. direct run-off into nearby watercourses or onto ground, with potential risk to groundwaters.

   iii. via the foul drainage system, with pollutants either passing unaltered through a sewage treatment works or affecting the performance of the works, resulting in further environmental damage.

   iv. through atmospheric deposition, such as vapour plumes.

The information in this guidance note is based on CIRIA (Construction Industry Research and Information Association) Report 164 (Reference 3), which contains detailed information on hazard identification, risk assessment and secondary containment systems.

2. CONTAINMENT SYSTEMS

On any site there may be one or more levels of containment. In deciding the appropriate level of containment a risk assessment will be helpful. The operator should consider the hazardous materials on site, the risks posed by accidents, fire, flooding and vandalism, likely failure mode of the primary containment, the sensitivity of the receiving environment and the importance of preventing any resultant discharge to it.

a. Primary containment

This is the tank or vessel in which the material is stored. It is, therefore, the first line of defence, and must be fit for the purpose. Temporary storage vessels should not be used for long term storage.

b. Secondary containment

Depending on the way they provide protection, secondary containment systems may be categorised broadly as local, remote or combined (both). Local containment is, in most cases, a bund. For further details see the Agencies' guidance on bunding, PPG2 - Reference 4.

3. REMOTE CONTAINMENT SYSTEMS

In many cases, primary and local containment (bunding) will prevent an incident from causing pollution. However, where local containment is not provided, or risk assessment indicates that additional security is required, for example to contain firewater run-off, which may amount to thousands of cubic metres, then "remote containment" systems may be employed. These may be used in isolation, or in combination with local containment, for anything from a small area, covering part of a site, to a number of large individual installations. They may be required to protect both surface and foul water drainage systems. The following sections describe the types of system available and the factors to be taken into account when using them.

In calculating the capacity for remote containment systems, the operator should consider the following factors and the extent to which they apply to his site. Detailed technical guidance on remote containment systems, the methodologies for calculating fire water volume (section iii), allowances for rainfall and dynamic effects will be found in Reference 3.

i. Primary capacity - 100% of primary capacity. Consider the possible failure modes and where appropriate, include the capacity of all primary tanks in multi-tank installations.

ii. Rainfall - subject to operational procedures, in order to calculate the volume to be contained, allow for a 10 year return, 8 days rainfall prior to the incident, and a 10 year return, 24 hour rainfall, plus an allowance for rain falling directly on to remote containment and areas of the site draining into it, immediately after the incident. The post-incident component and the allowance for dynamic effects (see v) are not additive.

iii. Fire fighting and cooling water - Allowance for extinguishing and cooling water delivered through fixed and non-fixed installations based on BS5306, VCI, CEA, ICI and Institute of Petroleum (Reference 5) methodologies, with appropriate adjustments in the light of the particular circumstances. Consultation with the regulators and the fire service essential.

iv. Foam - Allow a freeboard of not less than 100 mm.

v. Dynamic effects - this is to allow for the initial surge of liquid and for wind-blown waves. In the absence of detailed analysis, allow 250mm (750 mm for earth walled bunds).

a. Containment Lagoons

Where the site topography and the ground and soil conditions are suitable, earth banked containment basins (or lagoons) can provide cost effective, remote secondary containment systems, particularly for the retention of firewater. Lagoons may be constructed either above or below the surrounding ground level and formation level is often determined by the economic advantage of balancing cut and fill.

To protect groundwater, the lagoon should be substantially impermeable. In some situations this will require the use of an impermeable membrane or other suitable liner to ensure that it does not leak in the event of an incident occurring. In situations where a membrane is not required, it is recommended that a minimum of 1 metre of engineered clay, with a maximum permeability of $1x10^{-9}$ m/sec, is used to line the lagoon.

Lagoons should be constructed so that they can be isolated in an emergency from the main drainage system. Flood defence installations, such as a balancing lagoon or shared, off-site flood storage facilities may be used to contain fire-fighting run-off, providing that they incorporate shut-off devices. If pumped storage or transfer facilities are in use, a back-up power supply should be considered.

b. Tanks

Purpose-built tanks may be used for the containment of fire-fighting run-off or spillages. Although most tanks are not designed specifically for the containment of spillages or firewater, the UK standards for liquid storage tanks and vessels are high and many of these are suitable for use as secondary containment. They may be more expensive to construct than lagoons, but this can be offset by the smaller land area required. In addition, a tank may facilitate firewater reuse in appropriate circumstances (see Section 4.d.iv).

The actual type, size, design standards and protective finishes of the tank will be influenced by the site's risk rating, the retention time, the quantity and the nature of the materials stored. Where available, an economical option might be to make use of an adequate redundant or spare tank.

Tanks can be constructed both above and below ground. The various types available are listed below.

Above ground tanks	Below ground tanks
proprietary cylindrical tanks as used for agricultural waste	reinforced masonry tanks
welded steel tanks as used for oil, petroleum and other liquid products	in situ reinforced concrete
sectional steel rectangular liquid storage tanks	tanks formed with embedded sheet piling walls
reinforced plastic tanks	reinforced plastic tanks
reinforced concrete tanks	welded steel tanks as used for oil, petroleum and other liquid products
reinforced concrete/masonry tanks	deep shaft tanks

Other materials used include stainless steel, aluminium and plastic. The last two are limited by their poor resistance to fire.

The tank will need to be protected from corrosion and aggressive conditions. This may be provided by a range of coatings, including bitumastic paints, epoxy coatings and rubber and glass linings. These will be determined by the substance to be contained, as well as other corrosive influences.

In all cases, it is recommended that a minimum freeboard of 300 mm is provided as a buffer capacity. No overflows should be permitted within the freeboard depth. Tanks that are open to rainwater will require regular monitoring and emptying to maintain the necessary containment capacity. The most onerous loading conditions should be considered for design purposes. The overall depth of the tank including freeboard, should be taken as the minimum design depth when assessing the static head of contained liquids.

In some emergency situations it may be possible to use storm tanks on the sewerage system, at a sewage treatment works (STW) or at other effluent treatment facilities. This will require consultation with the sewerage undertaker or treatment plant operator. This option should only be used as a last resort and should not be relied upon, as the tanks may be full in the event of a storm. The effects of the discharge on the STW should also be considered, as damage to the treatment process may result in greater environmental harm, due to the discharge of raw or partially treated sewage, as well as the contaminated run-off. Alternative means of disposal may need to be considered if the contained material is unsuitable for treatment at the STW.

c. Shut-off valves and penstocks

Shut-off valves or penstocks which can isolate part or the whole of a site facilitate the retention of spillages or fire-fighting run-off on site. Their effectiveness depends on the capacity of the drainage system. They may be operated manually or triggered by means of automatic sensors. As a general rule, simple systems are best.

Automatic sensors and closure devices may be used to ensure a rapid response on sites where an incident might not be immediately noticed. It is vital that such devices are properly maintained and regularly tested. In the event of an incident, it is essential to verify that they have functioned properly as soon as possible, either by inspection or the use of telemetry. In all cases, consideration should be given to the consequences of overflows from gullies and other entry points to the drainage system.

d. Oil separators

Oil separators are devised to contain spillages of hydrocarbons and other, lighter than water, immiscible liquids. They will not contain soluble substances such as soluble oils and their action is adversely affected if degreasing agents or detergents, such as those used in some fire fighting foams, are present. If separators are to be used to contain large spillages, bypass type separators should not be used. Separators may also be fitted with a penstock valves at both inlet and outlet to provide flexibility in handling spillages. See PPG3-Reference 6, for further details.

4. EMERGENCY CONTAINMENT SYSTEMS

Although permanent containment facilities should be provided at many sites, there may be circumstances where a spillage cannot be dealt with by such facilities, for example if it occurs outside a bunded area. In other cases, particularly at smaller sites, firewater containment facilities may be impracticable because of cost and space considerations. In such cases, temporary containment systems or pollution control materials should be considered.

If reliance is placed on these secondary measures, consideration of some other form of local containment may be necessary to provide sufficient time to prepare them. Their use and location must be clearly marked in the pollution incident response plan and indicated on site with durable signs explaining their use. Examples of emergency containment measures include:

a. Sacrificial areas

This method relies on the conveyance of firewater to a remote, designated sacrificial area, designed to allow infiltration and to prevent run-off. Design details are included in Reference 3. The contaminant is contained within a layer of permeable soil or porous media and should be prevented from dispersing into other strata or groundwater by an impermeable lining system which should be capable of containing both vertical and horizontal flow. The area may also be used for other purposes, such as car parking or as a sports ground. The stormwater drainage serving the area must be capable of being shut off quickly and effectively during an incident, until the contamination is dealt with. After use, if the area has been contaminated, the permeable material should be excavated and removed for disposal.

Such an area could also be used for controlling stormwater run-off from the site, which helps in the management of flooding and pollution from surface run-off. The Agency encourages this form of development (see Reference 7).

b. Bunding of vehicle parking and other hard standings

Impermeable yards, roads and parking areas can be converted to temporary lagoons using sandbags, suitably excavated soil or sand from emergency stockpiles to form perimeter bunds. Permanently installed bunding, in the form of either a low kerb or roll-over bunds around suitable impermeable areas, the entire site, or just the sensitive area, is a better option. In the event of an incident, all drain inlets, such as gullies, within the area, must be sealed to prevent the escape of the pollutant. See Section 5e for details of suitable drain sealing equipment. If appropriate, a liner may be used to improve the impermeability of the land surface.

c. Pits and trenches

Pits or trenches may be used where other methods have failed or no other method is available. Their use should be considered carefully due to the risk of groundwater contamination. If possible, a liner should be employed, particularly in areas of high groundwater vulnerability, although the effect of the substances being contained on the liner will need to be considered. If no liner is used, the contaminated ground will need to be removed promptly to a disposal site. Pits and trenches may also be used to add reagents for neutralising harmful substances.

d. Portable tanks, overdrums and tankers

Portable storage tanks made from synthetic rubber, polymers and other materials come in a wide variety of sizes. The portability of the tanks allows them to be moved rapidly to the fire or spillage location, or to where any run-off has been contained. If a portable tank is to be used during an incident, the following measures need to be considered:

i. As part of the pollution incident response plan, suitable points in the drainage systems must be pre-selected at which the drainage pipe can be blocked and a man-hole chamber used as a pump sump to transfer contaminated waters to the tank. A suitable pump, which may need to be flame-proof, will also be required.

ii. Locations for the erection of portable tanks must be pre-selected (areas such as car parks are most suitable), ensuring that there is both sufficient space and an adequate foundation.

iii. Larger sizes become increasingly unwieldy and will need to be supported by a frame.

iv. Consideration may also be given in the pollution incident response plan to the re-use of the collected water to tackle the fire. This should take into account the materials present on site and the risks to equipment, through contamination, and to the safety of fire crews.

v. Overdrums, which are designed primarily to safely store leaking or damaged drums, can also be used as a temporary store for a small quantity of a spilt liquid.

vi. Re-usable liners are available for overdrums and portable tanks. These must be resistant to attack by the stored substances.

vii. Vacuum or similar mobile tankers may also be used for collecting and containing small spills

5. EMERGENCY MATERIALS AND EQUIPMENT

A wide variety of products are available to deal with spillages or to contain spills in emergency containment areas, some of which are listed below. Any materials or equipment used must be well maintained and strategically placed at accessible locations which are clearly marked with durable notices explaining their use. The pollution incident response plan should identify pollution prevention equipment and materials and their location. The Agency does have emergency equipment and facilities, but these may not always be available.

a. Sand and earth.

These are versatile containment materials which may be used to soak up spillages of oil and chemicals and used in sand bags to block off drains or to direct flows to a predetermined collection point. Sand should be kept dry and a shovel should be available. Contaminated material must be properly disposed of and must not be washed into the drainage system.

b. Proprietary absorbents

These serve a similar purpose to sand. They are available as granules, sheets, pillows or a loose powder. Although most absorbents are designed for hydrocarbon spills, products are available for chemical spills.

c. Sealing devices and substances for damaged containers

These devices and materials are designed for use when a tank, storage drum, valve or pipe has been punctured or damaged. Leak sealing devices may take the form of a pad or clamp which is put over the damaged area like a plaster, or they may be preshaped, inserted into the damaged area and then inflated. Leak sealing putties are also available, ready made or supplied in a dry powder form for mixing with water. These are applied over the damaged area to form a temporary seal. A more permanent method may be required before moving the damaged vessel.

d. Drain seals

There are several types of drain seal, including those which can be used to seal a drainage grid by covering or blocking the drain and those which fit in a pipe. The use of a pipe seal may enable the drains to be used as a retention system, which may provide a significant volume of containment. Drain seals should be kept in a readily accessible location close to where they would be used. Care should be taken in their installation to avoid exposure to hazardous conditions and to ensure the contained liquid does not overflow from gullies or elsewhere on the drainage system.

e. Booms

Booms designed for use on watercourses may also be used to isolate drains or divert or contain spillages. There are two types of booms. Absorbent booms are filled with absorbent material which can be suitable for hydrocarbons, aqueous chemicals or both. Plastic physical barrier booms can be inflated with air or water.

6. WASTE MANAGEMENT

Measures should be in place to dispose of, as soon as possible, any spillage, contaminated material or fire fighting water. Where re-use is possible, the spilled material should be returned to storage on site. If off-site disposal is required, a registered waste carrier should be used, although if a foul sewer is available it may be possible to discharge to it with the approval of the local sewerage undertaker. It may be possible to treat hydrocarbon contaminated water using site oil separators, but the presence of foam can adversely affect their efficiency.

The movement of the waste will need to be documented with a transfer note under the Duty of Care Regulations 1991 (Reference 8), or if it is a special waste, with a special waste consignment note under the Special Waste Regulations 1996. The producer will need to keep these notes for a statutory period of two years for transfer notes or three years for consignment notes.

In the case of special waste consignments, there is normally a requirement for three days notice to be given to the Agency prior to movement. In an emergency this may be waived, providing the local Agency office is contacted.

7. FIRE-FIGHTING STRATEGIES AND RUN-OFF MANAGEMENT

The Plan may consider fire fighting strategies and possible methods of reducing the amount of firewater run-off generated, for example by the use of sprays rather than jets, controlled burn and the possible re-cycling of fire-fighting water, where safe and practicable to do so. Advice on this should be sought from the Fire Service, based on best fire-fighting practice.

8. REFERENCES

1. PPG11 - Preventing pollution at industrial sites
2. PPG21 - Pollution incident response planning
3. Design of Containment Systems for the Prevention of Water Pollution from Industrial Incidents - CIRIA Report 164: Construction Industry Research and Information Association: Telephone 020 7222 8891
4. PPG2 - Above ground oil storage
5. Fire precautions at petroleum refineries and bulk storage installations, Institute of Petroleum Model Code of Safe Practice, Part 19
6. PPG3 - The use and design of oil separators
7. Sustainable urban drainage – an introduction: Environment Agency/SEPA/Environment and Heritage Service
8. Waste Management - The Duty of Care - A Code of Practice: ISBN 0-11-753210-X: The Stationery Office, Telephone 08706 005522

Other useful source documents

9. A Guide to the Control of Major Accident Hazard Regulations 1999; L 111 HSE Books, Telephone 01787 881165
10. Code of Practice for the Safe Design and Operation of Timber Treatment Plant; Environment Agency/British Wood Preserving and Damp Proofing Association, 1998: Telephone 020 8519 2588
11. Inspection and Approval of Agrochemical Stores by Environmental Protection Officers and Fire Officers in connection with BASIS Registration Ltd: BASIS (Registration) Ltd 2000: Telephone 01335 343945.
12. Environmental guidelines for petroleum distribution installations: Institute of Petroleum, ISBN 0 85293 166 2
13. Design, construction and operation of distribution installations: Institute of Petroleum Model Code of Safe Practice, Part 2

Reference 1,2,4,6 & 7 are available free of charge from your local Agency office.

References 5, 12 & 13 are available from the Institute of Petroleum, telephone 020 7467 7100

All the Agencies' pollution prevention guidance notes are available on the web sites listed below.

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