

Groundwater Protection Code

Solvent Use & Storage



Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

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About this code

This chapter explains:

- what the code is, and why it is important to follow it
- who the code is aimed at
- the legal framework relevant to groundwater and the code

Why a code?

- 1.1 Inappropriate use and disposal of even small quantities of organic, and particularly chlorinated, solvents can seriously pollute groundwater rendering it unusable for supply purposes and toxic to aquatic life. Groundwater is an important source of clean water which, once contaminated, is very difficult and expensive to make good, and for this reason there are UK and EC laws to protect it.
- 1.2 Any business using solvents falling under List I or List II of the Groundwater Regulations 1998 must comply with the Regulations. This code provides guidance which will help you to do so. Failure to comply with the Regulations could result in contamination of valuable groundwater and as a consequence may result in serious penalties, costs and liabilities.

What sort of code?

- 1.3 Because of the wide range of businesses and activities in which solvents are used, it is not practical for the code to be a prescriptive list of procedures to be followed in all cases. However, in order to be helpful to smaller businesses, self-contained sections (covering activities such as handling, storage and disposal of solvents) set out fairly detailed lists of actions which may need to be considered when deciding how best to avoid groundwater pollution. These lists, which are based on current good practice principles and techniques, are for guidance only – it is up to the user to follow the guidance, or take other measures, to ensure that the Groundwater Regulations are complied with in a specific case.
- 1.4 The Environment Agency has powers under the Groundwater Regulations to serve a notice on anyone carrying out an activity which could put groundwater at risk from listed substances. When deciding whether to serve such a notice, the Agency will consider whether the relevant guidance in the code has been, or is likely to be, followed or whether other measures have been taken which would meet the requirements of the Regulations.
- 1.5 The code is not intended to address matters relating to health and safety or non-groundwater environmental issues since these are the subject of other regimes, codes and guidance. Any cross-cutting matters are addressed in the code from the perspective of groundwater protection and it is important that other relevant codes and guidance continue to be observed.

Who is the code aimed at?

- 1.6 The code will be relevant at all sites in England and Wales where solvents are produced, stored, used, handled or processed, no matter how large or small scale the operation or the type of business activity. These are referred to as 'solvent sites' in the text.
- 1.7 For the purpose of this code, the term "solvent" covers a range of substances specifically designed to act upon other substances as a dissolver, disperser, de-greaser, viscosity adjuster, surface tension adjuster, preserver or plasticiser. Solvent types and uses are listed at Annex A.
- 1.8 The advice is specifically aimed at the following:
 - the owners of solvent sites
 - operators at solvent sites
 - persons involved in the delivery or loading at solvent sites
 - persons involved in designing and constructing solvent sites
 - persons involved in decommissioning solvent sites
- 1.9 It will be particularly relevant to those businesses which are not subject to integrated pollution control regimes under the Pollution Prevention and Control Regulations. However, the code will still be relevant at Part A sites since the permit for operation of such installations or mobile plant is treated, under the Groundwater Regulations, as a groundwater authorisation. Thus compliance with the Regulations must be demonstrated.

Legal requirement to protect groundwater

- 1.10 UK legislation includes the Groundwater Regulations 1998 and the Water Resources Act 1991. Their purpose is to protect groundwater from contamination and they control direct and indirect discharges to groundwater. A direct discharge is straight into groundwater, i.e. directly into (at or below) water table. An indirect discharge may occur after percolation through the soil.
- 1.11 The Groundwater Regulations "in effect" prohibit:
 - a. discharging "List I" substances directly to groundwater
 - b. disposing of "List I" substances to land without prior authorisation from the Environment Agency
 - c. discharging directly to groundwater, or disposing to land, "List II" substances (which include many solvents) without prior authorisation from the Environment Agencyand they provide the Environment Agency with powers to prohibit or control any activity which is causing, or could cause, groundwater pollution.
- 1.12 Groundwater protection is also integrated into a number of other laws and regimes at both European and UK level. Annex B provides a summary of some of the key laws and regimes.

Using the code

This chapter explains:

- how to apply the code to different types of site or activity
- the type of risk posed by solvents and how to assess them
- how to demonstrate compliance with the code

Using the code appropriately for a specific activity or site

- 2.1 Because this code applies to a wide range of circumstances where solvents are used, the relevance of individual elements will vary. However, the general approach recommended is to:
- a. understand how solvents can pollute groundwater
 - b. identify where pollution risks could occur in relation to the site or use
 - c. put measures in place to address those risks by following the guidance
- 2.2 This chapter provides a general explanation of how and why pollution can occur, the sorts of processes which give rise to pollution, and what sorts of steps you should take to demonstrate that you are protecting groundwater. Chapters 3 and 4 identify risks and ways of dealing with them in relation to sites (including layout and infrastructure) and activities (including purchasing, delivery, storage, maintenance and disposal). Chapter 5 covers contingency measures which should be put in place to address emergencies.

Why solvents pose a risk to groundwater

- 2.3 All solvents have the potential to pollute groundwater by affecting the taste and odour of drinking water sources. In addition, certain solvents are classified as human carcinogens or mutagens, or as toxic to reproduction. A number are classified as toxic to aquatic life and can enter rivers via pollution of groundwater due to losses from the site or business activities.
- 2.4 Because solvents are highly mobile and can have a detrimental effect at very low concentrations, just one litre of solvent can pollute over ten million litres of groundwater. Once solvents have entered the aquatic environment, they are extremely difficult and expensive to clean up. Some solvents dissolve rapidly into groundwater and others sink below the water table but both types cause pollution which can travel significant distances from the initial source.

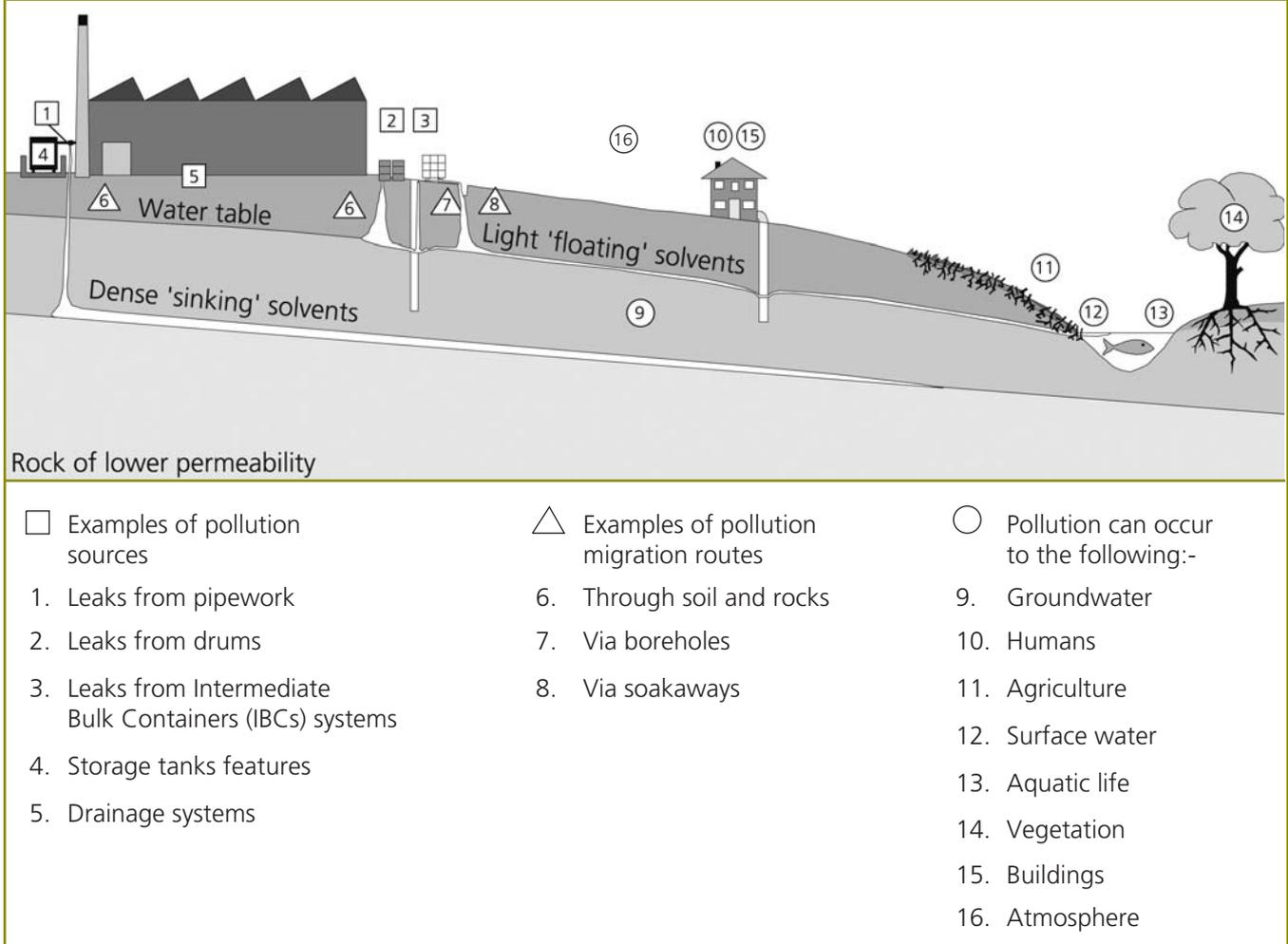
How solvents reach groundwater

- 2.5 The routes by which groundwater can become polluted are not always obvious. They can originate at sources such as drums and IBCs, storage tanks and pipework or drainage systems. Once pollution has occurred, it can follow a number of pathways – most obviously through the soil and rocks – to reach groundwater. Groundwater feeds surface water and is

Chapter 2

also used as drinking water, for food production and agriculture – uses which can be seriously affected by pollution. The diagram below illustrates some of the possible routes for contamination.

Figure 1 Possible routes for contamination by direct and indirect discharges



Assessing your site and activities for pollution risks

2.6 As a first stage in addressing pollution, you should think about how and where you use solvents and where the risks of groundwater pollution could occur. The Agency may be able to give advice on the suitability of your assessment when you have completed it. Activities with potential for loss of solvents, and therefore key ones to consider, include:

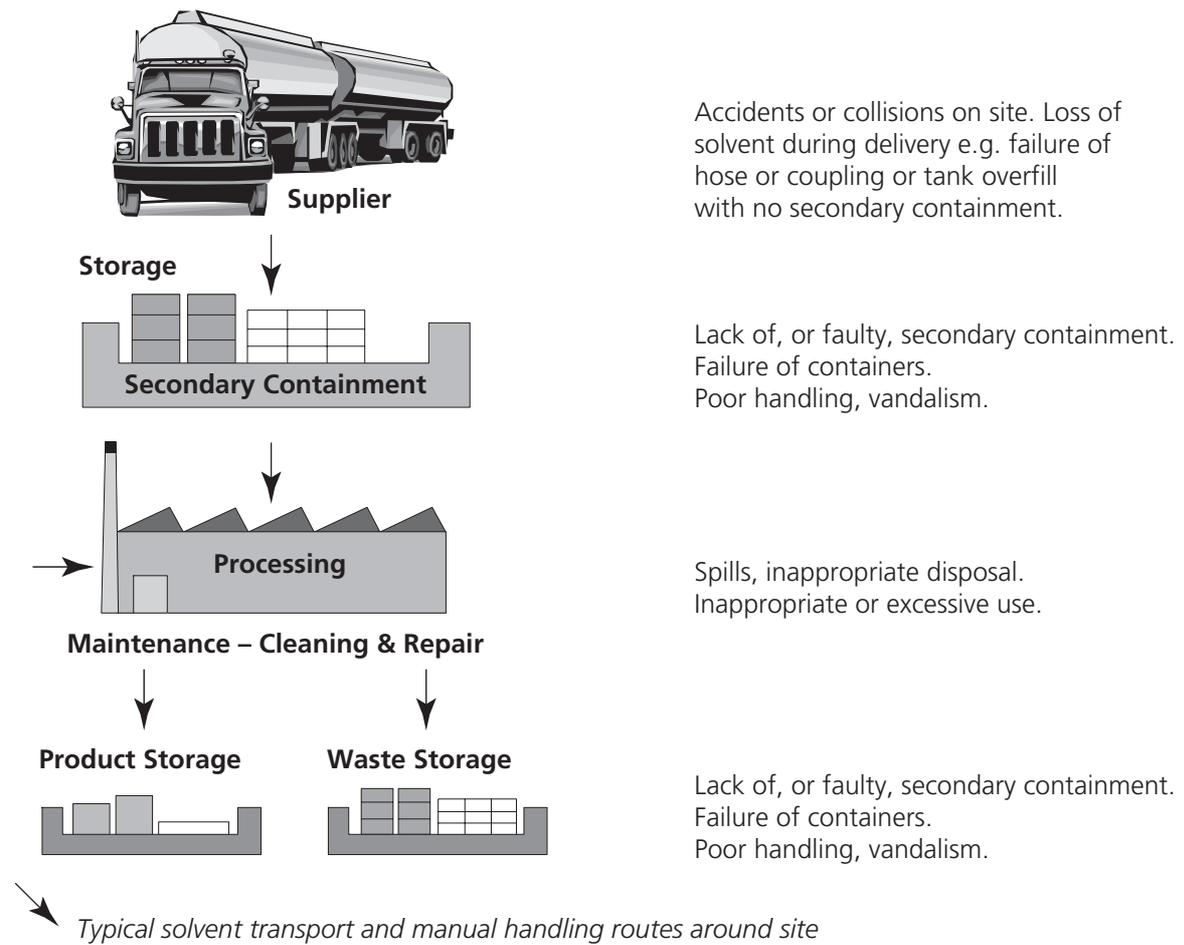
- supply of solvent to site
- storage of new and waste solvent
- handling/moving and dispensing of solvent around the site
- manufacture, use or processing of solvent
- waste disposal, recovery and recycling
- cleaning, maintenance and repair
- decommissioning

2.7 When considering risks arising from activities on the site it may be helpful to think in terms of the likely movement of solvents through site, from arrival to departure, and the risks which occur at each stage. Solvent movement through a typical site, and the hazards associated with those movements, are set out in the diagram below.

Figure 2 Hazards associated with movement of solvent on-site

Movement routes

Hazards



Accidents or collisions on site. Loss of solvent during delivery e.g. failure of hose or coupling or tank overfill with no secondary containment.

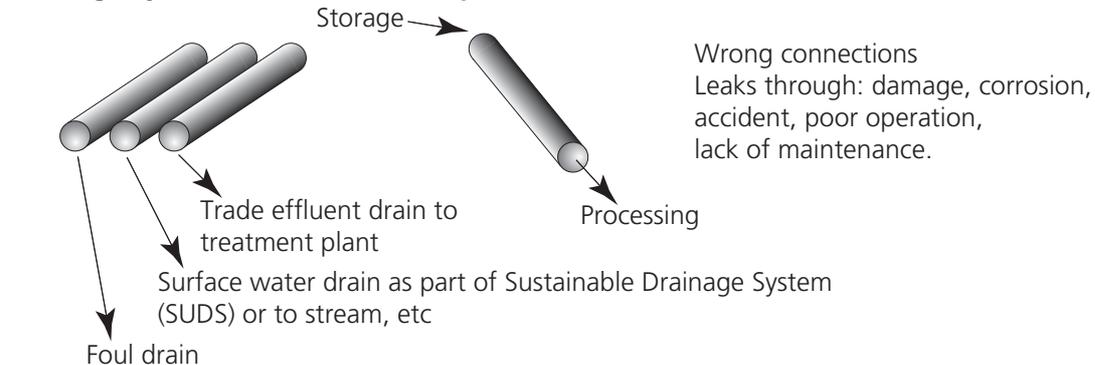
Lack of, or faulty, secondary containment.
Failure of containers.
Poor handling, vandalism.

Spills, inappropriate disposal.
Inappropriate or excessive use.

Lack of, or faulty, secondary containment.
Failure of containers.
Poor handling, vandalism.

Drainage Systems

Process Pipework



Wrong connections
Leaks through: damage, corrosion, accident, poor operation, lack of maintenance.

- 2.8 Once risks have been identified, it will be necessary to ensure that any necessary infrastructure changes, and changes to management systems and controls, are properly planned and implemented in a timeframe appropriate to the risk to groundwater. It will also be necessary to put emergency procedures in place so as to minimise environmental impacts in the event of loss of product or any other emergency. Chapters 3, 4 and 5 give advice on these matters.
- 2.9 It is important that consideration of risks is not a “once only” process, but that it is on-going. In particular, risks will need to be considered in relation to any planned change to the site or operations on it.

Demonstrating that this code has been followed

- 2.10 In order to demonstrate that this code is being followed, documentary and site evidence should be available to show that:
- environmental risks have been considered and identified
 - any necessary changes to infrastructure, management systems (including inspection, maintenance, and any relevant written procedures), and emergency procedures have been implemented, or planned, in a way appropriate to the risks and in accordance with the advice in the code

Your site

This chapter explains:

- groundwater protection issues relating to
 - site and infrastructure design and layout
 - maintenance
 - changing or closing the site
- site and infrastructure plans

General site layout

- 3.1 The way your site is designed, and how you use it, will significantly affect the likelihood of solvents being lost or spilled. When commissioning a site, or considering potential risks associated with an existing site, you will need to give attention to areas where solvents are delivered, transported through the site, stored (whether as unused product or waste), used or poured, and removed from the site as waste or product.
- 3.2 Advice on each of these aspects is given below but, in general, good design and layout should ensure that the following basic requirements are achieved:
- sufficient space allowed for solvent movement and use
 - impermeable surfaces and, where necessary, bunding sufficient to contain any spills
 - correct positioning and integrity of drains, sumps and soakaways
 - lack of congestion around the site
 - attention to security to reduce risk of vandalism

Where any existing site layout makes achievement of any of these requirements difficult, you should consider whether alternative measures are needed, contacting the Environment Agency where necessary.

Layout of delivery/removal areas and transportation routes

- 3.3 Delivery, removal and transportation of solvents can pose significant risks to groundwater both directly by damage and spillage from solvent containers in transit, or indirectly by collision with solvent storage vessels and pipework. For this reason the following matters should be considered with respect to site layout and design:
- delivery areas should be large enough to accommodate delivery vehicles and any handling equipment
 - appropriate containment systems, including bunding where necessary, should be in place to ensure that spills can be properly contained
 - transportation routes through the site should, as far as possible, be clearly marked, free from obstacles, surface water drainage systems, sumps, soakaways, and unprotected pipework

Layout of storage areas

- 3.4 Pollution of groundwater in storage areas typically arises due to failure of the integrity of the container resulting from neglect, damage, vandalism, poor handling, poor installation (in the case of permanent storage) and poor secondary containment systems. Much can be done to reduce these risks by appropriate siting and design of the storage areas. You must design your storage areas so that any spillage or loss can be recovered without discharge to surface water drains, soakaways or the ground. In addition storage areas should ideally:
- be positioned and laid out in a way which allows regular inspection of containers and reduces the risk of spills or vandalism;
 - have impermeable flooring and/or bunds to contain spills
 - be located on ground level, never on roofs
 - be protected from any weather conditions which could affect the integrity of either the containers themselves or any secondary containment systems (see sections 3.11-3.14 below)
 - be well lit to minimise the risk of spillage and to ease detection of leaks
- 3.5 You should be aware that leak detection systems are available for storage areas and should critically assess the need for such system in the light of the size, design, type of solvent, layout and management of your storage area.

Layout of activity areas

- 3.6 Areas where solvents are poured or used should be designated, properly labelled areas which:
- have impermeable flooring away from surface water sources, surface water drains, soakaways, drinking water boreholes or sumps
 - ideally are within properly bunded areas
 - are sufficiently uncongested to reduce risk of accidental spills

Where it is impractical or impossible to handle and pour solvents away from surface drains, appropriate protective equipment, such as drain covers and flexible dams, should be used.

Infrastructure – choice and positioning

- 3.7 The choice and location of pipework, secondary containment, drainage systems and any other infrastructure at a solvents site will have a significant impact on the risk of groundwater pollution and, potentially, on maintenance requirements and costs. Any infrastructure should be appropriate to the quantity of solvents being used, and should be positioned to avoid any risk of damage and allow proper maintenance and cleaning.

- 3.8 **The use of underground storage tanks (USTs) for solvents can present a particular risk to groundwater and for this reason should be avoided where possible.** Visual inspection of such tanks is not possible, corrosion risks are greater, and there are few chances for leaks to be intercepted or attenuated. If an existing UST is in use, and alternative storage measures could be provided, plans should be agreed for its replacement with above ground storage within an appropriate period. Where the use of USTs is considered to be unavoidable, the operator should discuss with the Environment Agency appropriate measures to check and record the integrity of tanks, and also appropriate leak detection methods. **Failure to address these points would be treated seriously by the Environment Agency in enforcing the requirements of the Groundwater Regulations.**

Pipework

- 3.9 Leaks from pipework containing solvents can arise from corrosion, impacts or poor maintenance. Joints are particularly susceptible to these hazards and poor positioning of pipes can result in damage caused by impacts. Risk of pollution arising from a leak will increase if the leak cannot be detected, and if routes from the leak to groundwater have not been addressed. To minimise risks, pipework should:
- be resistant to the solvents they carry or come into contact with;
 - be above ground and available to inspection and maintenance;
 - where appropriate, be labelled as to their contents;
 - have the minimum number of connections;
 - be located away from main road ways or suitably protected from impact damage;
 - where possible, be sited over impermeable surfaces and away from surface water drains, soakaways, drinking water abstractions and sumps
- 3.10 The above criteria also apply to taps, valves and pumps. These should, additionally, have clear labels and, where used for filling or transferring between containers, be over bunded areas.

Secondary containment and bunding

- 3.11 **To ensure adequate protection of groundwater, it is important that the operator of a solvent site provides appropriate secondary containment for all storage.** Secondary containment systems are necessary for several reasons. They retain solvents released from leaking containers. They also retain spills associated with fire and explosion in storage areas. Where secondary containment is not provided you should be able to demonstrate why it is not necessary.
- 3.12 Solvents can be stored in integrally bunded containers that offer their own internal secondary containment, in which case engineered solutions such as bunds and storage cabinets may not be required. Double-skinned containers are not necessarily designed for the secondary containment of liquid and should not be confused with integrally bunded containers. Where containment is sought to prevent discharge of fire fighting water, engineered solutions may be appropriate.

3.13 Containment can be as simple as spill decks and containment platforms that drums and integrally bunded containers stand on, or can range from safety storage cabinets and lockers with incorporated spill decks through to engineered solutions such as prefabricated systems made from steel or plastic, or in-situ systems generally constructed from concrete. Bunds are a common form of engineered containment system, with impermeable walls and floors, and are predominantly unroofed. Detailed advice on the requirements and construction of containment systems can be found in guidance produced by the Environment Agency and Health and Safety Executive. Details of this guidance are given in Chapter 6.

The type of containment system adopted at the site is dependent upon the type and quantity of solvents being stored and whether the storage area is within a designated building or external. The following general requirements and considerations should be observed in relation to containment systems:

- if containers used on site are not integrally bunded, secondary containment systems should be provided
- secondary containment systems should be impermeable and chemically resistant to the type of solvents being stored or used – concrete is not resistant to all types of solvent
- all enclosed secondary containment systems such as cupboards and bins should be clearly and properly labelled as to their contents
- no services (e.g. pipes, ducts) should pass through the secondary containment system

3.14 The following considerations will apply in particular to bunds:

- the capacity of the bund should be sufficient to contain a spillage arising from the worst credible failure in the storage system, plus 10% to take account of rainfall and the possibility of fire fighting water
- where multiple containers are stored the bund should be at least 110% of the capacity of the largest container
- the bund should be so designed that it can be kept free of rainwater and to allow spills to be removed safely
- spills and rainwater accumulations should be removed as soon as possible. This should ideally be via a pump over the bund wall or from a low point in the bund and not via valves or other arrangements in, or passing through, the bund wall
- there should be no surface water drains, soakaways, engineered sumps, separators, vegetation or combustible material within the bunded area
- bunds should be greater than 10m from watercourses and 50m from drinking water boreholes

Drainage

3.15 Site drainage systems can act as a route for solvent releases to groundwater. A frequently recurring factor in pollution of groundwater is poor maintenance and integrity of drains, sumps and soakaways and lack of awareness of the importance of their function in removing effluent safely. It is rarely appreciated that damage can often occur to drains through poor installation, settlement and damage from the roots of trees and bushes. Chemical corrosion may also affect the integrity of drainage systems.

- 3.16 Most existing sites will have two types of drains: **Surface water drains** (including land and roof drains) which tend to discharge to local rivers, streams or soakaways, usually with no treatment, and **Foul water drains** which carry contaminated water to a designated and consented sewage treatment works, storage lagoon or to a treatment system (these may be referred to as trade effluent drains).
- 3.17 The following requirements and considerations should be observed in respect of site drains:
- surface water drains should carry only uncontaminated water
 - site effluent and contaminated surface waters (e.g. from cleaning or run-off from hard standing in process areas) should be discharged to the foul drain
 - separators should be installed where necessary on site-drains
 - drains should be designed and constructed in such a way that they can be inspected and maintained to ensure that they are not damaged, leaking or blocked
 - drains should be clearly marked on plans and these should be available at all times to relevant staff (see section on Site and Drainage Plans at 3.25-3.27 below)

The use of signs and notices on the site

- 3.18 Many accidents leading to solvent loss occur through avoidable operator errors. A good system of signs around the site can drastically reduce the likelihood and effects of such losses. Signs and notices will be particularly useful for:
- identification of delivery areas, transport routes and storage areas
 - warning of hazardous materials or activities
 - encouraging good security and housekeeping, including cleaning and waste disposal practices
 - providing clear instructions relating to pipework, bunding and pouring areas
 - identification of emergency equipment and procedures

To be effective, signage should be clear and uncluttered, and only used where the information will be useful and serve a practical purpose.

Maintenance of the site and infrastructure

- 3.19 Groundwater pollution can occur as a result of infrastructure failure, such as ruptured pipework, corroded storage tanks and damaged bunds, or through failure in handling practices such as solvent spills on top of broken or pervious flooring. Regular and routine maintenance of equipment and surfaces can detect potential sources of failure and pinpoint potential areas of leakage. Early detection can limit the occurrence of failure and therefore prevent pollution of groundwater occurring.

3.20 Guidance on maintenance of equipment and infrastructure should, where possible, be sought direct from the supplier, but the following general principles will apply:

- a full annual inspection of bunds (to cover, for instance, structural integrity, corrosion of bund walls, stability etc.) should be undertaken by a competent person
- routine inspections on a risk basis should be carried out by competent staff to assess the integrity of site and infrastructure, including flooring, drainage, pipework, storage areas, containment systems and signage (the floor and lower section of the tank are prone to corrosion if they have not been coated)
- where inspections identify issues of concern, appropriate maintenance and repair should be undertaken within a time scale appropriate to the risk
- proactive measures should be taken to protect against recurrent issues (e.g. if damage frequently occurs through vehicle impacts, then take actions to divert vehicles or provide impact protection)
- preventative measures should be adopted to protect against failures resulting from the effects of weather (e.g. containers and pipes should be protected from overheating, corrosion and frost-damage)
- detailed written records should be kept of inspections, maintenance and repairs

Changing or closing your site

3.21 Changes to, or closure of, a site can result in product being lost to ground as a result of either deliberate or accidental release during dismantling and removal of pipework or other infrastructure or from abandoned plant and equipment. In addition, a risk could arise off-site if contaminated pipes and equipment are not disposed of in an appropriate manner.

3.22 Key considerations include:

- whether proposed methods for changing/decommissioning the site could result in release of product to ground or surface water?
- will any redundant equipment containing solvent remain in situ (e.g. in pipes, drainage system, tanks, bunds)?

3.23 If there is a risk of release of product to the ground or surface water, or if solvents would remain in situ in redundant equipment, the decommissioning proposals should be readdressed. In general it is preferable to remove all redundant pipework and equipment.

3.24 Specific care needs to be taken with respect to changing or decommissioning underground storage tanks. Consideration should be given to the relevant section of the "Groundwater Protection Code: Petrol stations and other fuel dispensing facilities involving underground storage tanks".

Site and drainage plans

3.25 It is important that up to date plans of the site layout and site drainage are maintained. These are necessary both for the routine operation and maintenance of the site, and to ensure that key information is available in the event of an emergency or spill. This section addresses those elements which should be included for environment protection purposes. Other requirements may be necessary for other purposes, such as health and safety.

3.26 **Site layout plans** should include the following:

- general layout of buildings and equipment on the site
- roads around the site
- clearly marked areas for emergency services
- location of storage areas
- location of waste storage areas
- routes of pipework (with any underground pipework clearly identified)
- routes of known or suspected buried services (including water and gas)
- location of spill kits and emergency clean up equipment
- location of bunded storage and containment areas

3.27 **Site drainage** should be clearly identified. A separate plan may be the best way of achieving this. The plan should show drainage layout and access, along with a schematic representation of the site drainage arrangements. In line with common practice, foul drains should be marked in red and surface water drains should be marked in blue and the direction of flow of both surface and foul drains should be marked (this colour coding could also usefully be used to mark drain covers and manholes on site). Other aspects which should be covered as appropriate on the drainage plan are:

- general layout of buildings and roads
- separators, sumps and soakaways on or near the site
- offsite discharge points for surface water and trade effluent
- any watercourses, boreholes or wells on or near the site
- the location of sprinkler control valves (where present) and mains water stopcock
- facilities such as inspection points for the detection of pollution ie retention or balancing tanks, fire-water retention ponds, containment tanks, drains and oil separators
- locations around the site suitable for portable emergency storage
- location of points where bungs and plugs can be used
- location of the process areas and any on-site treatment areas for trade effluent or domestic sewage
- location of fire hydrants, fireboxes, cut-off valves and pollution prevention materials
- bunded areas, indicating product types stored in them and their retention capacity

Activities at your site

This chapter explains:

- issues relating to purchasing, transportation, delivery and storage
- good housekeeping
- disposal

Management and use of solvents

- 4.1 Effective management and use of solvents, and the training of staff which that implies, can have both financial and environmental benefits. Waste minimisation strategies should be considered for all sites since they are concerned with preventing and limiting waste production at source through the efficient use of raw materials, energy and water. Improving the efficiency in use of raw materials can reduce production costs, the volumes of waste generated and, as a result, disposal costs. It can also reduce the potential risks posed to groundwater through accidental discharge, and any consequent fines and liabilities.
- 4.2 On smaller sites effective resource management and proactive environmental protection can often be addressed by appointing competent persons to oversee environmental issues and focus on the efficient use of solvents. Larger sites may have specialist environmental staff. The development and adoption of an Environmental Management System may also provide a structured approach to establishing and implementing an environmental policy and would also help to demonstrate compliance with this code.
- 4.3 Particular activities at your site which you will need to consider with respect to their contribution to the risk of groundwater pollution are: purchasing; delivery; storage; housekeeping and disposal. The following sections of this chapter identify key issues relating to each of these activities.

Purchasing

- 4.4 Solvent suppliers are legally required to provide a product safety data sheet (SDS) for each solvent. This contains information enabling the user to assess the risk of the intended use of the solvent and to establish risk management controls relating to, for instance, storage, handling, occupational exposure, accidents, environmental impact and waste management.
- 4.5 When purchasing solvents you should:
- only purchase the quantity of solvents required, and not more than you have capacity to store
 - ensure that the supplier provides an up-to-date safety data sheet (SDS)
 - read, understand and act on the information provided concerning the safe use of the solvents and prepare appropriate information to employees;
 - keep SDSs in a working file on site and available to all applicable staff

- ensure that solvents are delivered in appropriate, undamaged and clearly and properly labelled containers
- keep records of how much solvent is purchased, when and from whom

Delivery and on-site transportation

4.6 Delivery and transportation of solvents can pose significant hazards to groundwater both directly by damage and spillage from solvent containers whilst in transit, or indirectly by collisions with solvent storage vessels and pipework. The key groundwater protection considerations relating to managing delivery and transportation are:

- delivery areas and transportation routes should be kept clear of obstacles and sources of ignition
- appropriate equipment (e.g. fork lifts, trolleys etc) should be provided for the safe and controlled movement around the site (where solvents are highly flammable any movement must be in accordance with the Dangerous Substance and Explosive Atmosphere Regulations (DSEAR))
- staff should be trained in manual handling and equipment handling techniques
- where tankers are involved in deliveries and transportation, the shortest practical dispensing hose should be used
- solvent movements around site by contractors should be the responsibility of appropriately trained site personnel
- solvents should only be transported around site in suitable containers and where necessary secured so that they cannot fall off transport vehicles
- risk assessments should be carried out and appropriate measures taken to prevent ignition of flammable liquids or their vapours from vehicles

Storage

- 4.7 Solvents should be stored with a view to preventing release to groundwater and taking into account the suppliers recommendations. Solvent storage containers should be stored in areas where any accidental spillage or loss can be recovered without discharge to surface water drains, soakaways or to ground. In addition, action should be taken to prevent leakage as soon as any sign of leakage or adjacent surface staining is noted.
- 4.8 Solvents can be stored in a variety of containers. The most widely used containers are cans, drums and Intermediate Bulk Containers (IBCs), although on sites using large quantities of solvents, above and below ground storage tanks are also used. Pollution of groundwater from solvents in storage areas typically arises due to failure of the integrity of the container arising from damage, neglect, vandalism, poor handling and poor installation (in the case of permanent tankage).

- 4.9 Drums with large lids and rim clamps (e.g. open top 205 litre) should only be used for the storage of high viscosity solvents since they have a greater potential risk of leaks and spills compared to IBCs. This is because they deform easily causing lids to be ill-fitting, are prone to corrosion, and can be difficult to transport around the site. Traditional metal drums with small bungs used for filling and pouring are acceptable for storage provided that they are in a serviceable condition and stored according to the key issues listed at paragraph 4.10 below.
- 4.10 Routine inspections of site storage facilities and the integrity and condition of containers and tanks are critical to early identification of spills and leakages. Inspections should be documented and should be made against a checklist of inspection items established as part of a management system. Key issues for groundwater protection will be:
- the integrity of flooring, containment and bunding should be maintained – they should be clean and dry and any valves kept shut
 - storage should aim to protect groundwater taking into account the suppliers recommendations
 - an inventory should be kept of all solvents, chemicals and products stored (and used) on the site (see also Product inventories section in chapter 5)
 - containers and secondary containment should be chemically resistant to the solvents stored within them
 - containers and secondary containment systems should be clearly and properly labelled with appropriate warning signs
 - the quantity of solvents stored should be kept at a working minimum
 - containers should be of sufficient strength and integrity to ensure that they are unlikely to burst or leak – any damaged or unsuitable containers should be removed from use immediately
 - spare containers and hand transfer pumps should be available to transfer solvents from damaged containers, and overdrums should be available to encase damaged containers
 - drip trays should be placed beneath taps and valves in the storage area
 - taps and valves should be secure against improper use and vandalism if the site is not fully supervised
 - the storage area should be secure against unauthorised access and vandalism
 - spill kits and emergency equipment should be available and in good working order

Solvent auditing

- 4.11 For many operations major leaks (for instance, leaks at the bottom of tanks or from buried pipes) and spills can be detected through regular solvent auditing. By monitoring the quantity of solvents entering the site and measuring the quantity used and disposed of as waste, any discrepancies indicating significant loss of solvents can be identified. Auditing of individual storage tanks should also be considered where leaks would be undetected by other techniques. Information on solvent auditing can be found in Chapter 6. Alternative approaches to leak detection should be considered for operations for which auditing of this type is inappropriate.

Housekeeping

- 4.12 Poor solvent handling practices are a major cause of groundwater pollution. Good housekeeping protocols can be adopted that will reduce accidental leaks, spills and loss of resources. Maintaining and cleaning of equipment and surfaces is a vital part of housekeeping but can, in themselves, pose risks to groundwater. Cleaning and maintenance should be carried out on a regular basis following the advice below.
- 4.13 **Maintenance**, which will include the issues covered above, should be carried out by competent persons and should be undertaken, wherever possible, in designated areas away from surface water drains, soakaways, separators and surface water sources. Where there is a risk of loss of product during the maintenance operation, it should be carried out on an impermeable surface where any likely spills can be contained and disposed of safely. Drip trays, decanting pumps and shut-off valves should be used as appropriate. Maintenance of effective spill kits and emergency equipment is particularly important.
- 4.14 **Cleaning** is an important part of housekeeping but can pose the risk of solvents or harmful cleaning agents being washed to surface water drains, or to the ground, in contaminated waste water. For this reason the following precautions should be taken:
- cleaning products and water containing detergents, disinfectants, degreasers or any other cleaning agent should be discharged (after receiving any necessary prior consent from the local sewerage undertaker) to the foul sewer. Certain products claim to be “biodegradable” – these should still be disposed of to foul drain. Where a trade effluent consent to discharge to foul drain is required but not granted, then waste should be removed by a licensed waste carrier;
 - cleaning using streams or jets of water, or pressurised air, which dilutes or redistributes the waste or polluting substances should be avoided. Sweeping up is recommended unless there are other appropriate methods available;
 - cleaning should be undertaken in areas away from surface water drains, soakaways, separators and surface water sources, and
 - cleaning should be undertaken in areas which have containment systems in place and by appropriately trained staff

Disposal

- 4.15 Wastes containing solvents will normally be “controlled wastes” and so subject to specific legal requirements under the Environmental Protection Act 1990 and the Waste Management Licensing Regulations 1994. Waste containing solvents is likely to be hazardous and so subject to further controls under the Special Waste Regulations 1996. The Special Waste Regulations will be replaced by new regulations for hazardous waste during 2005.

Training

- 4.16 Many incidents that result in spills and leakages can be attributed to human factors such as operator error. These are often the result of inadequate or inappropriate training.
- 4.17 Training strategies should take account of operational needs (e.g. use of equipment or manual handling) and the need for a proper understanding of relevant groundwater and environmental issues. The level of training should match the responsibility of staff at the facility.
- 4.18 There are general legal requirements to provide staff and visiting contractors with health and safety training. From a groundwater protection point of view the following aspects are important in any training plan:
- supervision of deliveries
 - handling and transportation of solvents
 - understanding the importance of protecting groundwater, and the risks to groundwater at the site
 - completing waste transfer and consignment notes
 - dealing with incidents and emergencies, including reporting spillage/incidents and the use of spill kits and emergency equipment
 - undertaking and recording maintenance checks and repairs
 - good housekeeping
 - understanding legislative requirements relating to waste

Emergencies

This chapter explains:

- pollution incident response plans
- key emergency contacts
- emergency procedure protocols

Pollution incident response plans

- 5.1 The environmental impact of leaks and spills can be minimised if appropriate action is taken. An effective way of ensuring this is to draw up a Pollution Incident Response Plan (PIRP) for the facility which would normally address all environmental impacts, not only those relevant to groundwater. PIRPs can only be effective if staff and contractors are aware of the procedures in place. Regular procedural drills can be used to test their effectiveness and to familiarise staff.
- 5.2 As a guide, the following information should be incorporated in the PIRP. Every site is different, and other relevant information should be considered:
- emergency contact details
 - product inventory, including SDS
 - site layout plan
 - site drainage plan
 - location of emergency response equipment
 - emergency procedure protocol
 - incident reporting procedure
- 5.3 Copies of the PIRP should be accessibly stored on site and copies kept off site for reference in the event of an incident. In some cases this may need to be discussed in advance with the emergency services.
- 5.4 For clarity, a summary sheet can be added to the PIRP, containing information such as the company name, address, main business activities, solvents and quantities on site and recipients of the PIRP.

Emergency contact details should include the following as appropriate:

- staff key-holders (site, home and mobile numbers)
- sources of specialist advice
- emergency services
- specialist clean-up contractors
- Health and Safety Executive
- local Environment Agency office

- Environment Agency hotline number (0800 807060)
- local water supply company
- local sewerage undertaker
- Environmental Health
- local authorities

Product inventories will be appropriate for many sectors. These should give information on what products are used and stored on site, what quantities are likely to be present and where. It is also important to identify the environmental behaviour and mobility of the particular solvents on the site since they will have different properties and require various clean-up and emergency handling techniques. All the information should be kept up-to-date to provide a good indication of worst case scenarios and the necessary emergency and clean-up equipment needed. Key information, therefore, will be:

- an inventory of all solvents, chemicals and products on site
- the location of their storage areas
- their maximum quantity on site
- product SDSs

Site layout plans and **Site drainage plans** should be drawn up in accordance with the advice in Chapter 3 above.

Emergency response equipment should be appropriate to deal with the maximum spill that is likely to occur, be in good working order, and be easily found when needed (ie clearly identified in the PIRP). Staff should be appropriately trained to use it. Spill kits, including absorbent materials, shovels and drain bungs/covers should be readily available in positions where spills and leaks can occur including in areas for storage, deliveries and waste disposal. All emergency response equipment should be clearly marked and directions as to its use displayed. Its location should be shown on the site plan and inserted in the PIRP.

Emergency procedure protocols should be specific to the needs of the site and adequate for the worst case scenario. The level of response required under the protocol should be dependent upon the severity of the incident. Procedures which need to be considered for the protocol will be:

- notification of staff of an incident
- safe evacuation
- notification of emergency services, Environment Agency, Health and Safety Executive, local water supply and sewerage services and other emergency contacts as appropriate
- notification and evacuation of affected surrounding properties
- responsibilities of staff in emergency situations
- procedures for both large and small spills and assessment of priorities for actions
- safe handling and disposal of wastes arising from the incident
- cleaning and decontamination of personal protective equipment
- disposal of fire fighting waters

Sources of advice

This chapter explains:

- Environment Agency and Health and Safety Executive contact details
- key guidance and legislation

Environment Agency and Health and Safety Executive contacts

6.1 Advice on general groundwater issues and on environmental issues relating to the use of solvents can be sought from the Environment Agency. For emergency information, the Environment Agency Hotline number should be used. Please note that these numbers are correct at the time of publication of this code but, where used for the purposes of a Pollution Incident Response Plan, should be checked.

ENVIRONMENT AGENCY	General Enquiry Line Emergency Hotline	Tel. 0845 9333111 Tel. 0800 807060
Head Office	Rio House Waterside Drive Aztec West Almondsbury Bristol, BS32 4UD	www.environment-agency.gov.uk Tel. 01454 624400 Fax. 01454 624 409
Anglian Region	Kingfisher House Goldhay Way Orton Goldhay Peterborough, PE2 5ZR	Tel. 01733 371811 Fax. 01733 231840
Southern Region	Guildbourne House Chatsworth Road Worthing West Sussex, BN11 1LD	Tel. 01903 832000 Fax. 01903 821832
Midlands Region	Sapphire East 550 Streetsbrook Road Solihull, B91 1QT	Tel. 0121 7112324 Fax. 0121 7115824
South West Region	Manley House Kestrel Way Exeter, EX2 7LQ	Tel. 01392 444000 Fax. 01392 444238
North East Region	Rivers House 21 Park Square South Leeds, LS1 2QG	Tel. 0113 2440191 Fax. 0113 2461889
Thames Region	Kings Meadow House Kings Meadow Road Reading, RG1 8DQ	Tel. 0118 953 5000 Fax. 0118 950 0388
North West Region	Richard Fairclough House Knutsford Road Warrington, WA4 1HG	Tel. 01925 653999 Fax. 01925 415961
Environment Agency, Wales	Cambria House 29 Newport Road Cardiff, CF24 0TP	Tel. 01222 770088 Fax. 01222 798555
HEALTH & SAFETY EXECUTIVE	General enquiries & publications	www.hse.gov.uk Tel. 0845 3003142

Key guidance

- 6.2 The following guidance is correct at time of publication of this code and should be updated by contacting the sources when reviewing your Pollution Incident Response Plan.
1. *Storage and handling of drums & intermediate bulk containers: Environment Agency, Pollution Prevention Guidelines, PPG 26*, available by telephoning 08457 337700 or by e-mail to environment-agency@DMSLTD.co.uk
 2. *Health & Safety Executive (HSE), HS(G) 51, 1990. The storage of flammable liquids in containers*, available on www.hse.gov.uk
 3. *Health & Safety Executive (HSE), HS(G) 140, 1996. Safe Use and Handling of Flammable Liquids*, available on www.hse.gov.uk
 4. *Health & Safety Executive (HSE), HS(G) 176, 1998. Storage of flammable liquids in tanks*, available on www.hse.gov.uk
 5. *Preventing pollution on industrial sites: Environment Agency, Pollution Prevention Guidelines, PPG 11*, for availability see 1 above.
 6. *Use and design of oil separators in surface water drainage systems: Environment Agency, Pollution Prevention Guidelines, PPG 3*, for availability see 1 above.
 7. *Disposal of sewage where no mains drainage: Environment Agency, Pollution Prevention Guidelines, PPG 4*, for availability see 1 above.
 8. *General guide to the prevention of pollution: Environment Agency, Pollution Prevention Guidelines, PPG 1*, for availability see 1 above.
 9. *Above ground oil storage tanks: Environment Agency, Pollution Prevention Guidelines, PPG 2*, for availability see 1 above.
 10. *Maintenance of structures over water: Environment Agency, Pollution Prevention Guidelines, PPG 23*, for availability see 1 above.
 11. *A guide to the Special Waste Regulations 1996 (as amended)*.
www.environment-agency.gov.uk/commondata/105385/specwaste.pdf
 12. *Managing fire water and major spillages: Environment Agency, Pollution Prevention Guidelines, PPG 18*, for availability see 1 above.
 13. *Working at construction and demolition sites: Environment Agency, Pollution Prevention Guidelines, PPG 6*, for availability see 1 above.
 14. *Pollution incident response planning: Environment Agency, Pollution Prevention Guidelines, PPG 21*, for availability see 1 above.
 15. *Environmental Technology Best Practice Programme, 1996. Good Housekeeping measures for solvents, GG28*, available by telephoning 0800 585794 or on www.envirowise.gov.uk
 16. *Environmental Technology Best Practice Programme, 1996. Cost Effective Solvent Management, GG13*, available by telephoning 0800 585794 or on www.envirowise.gov.uk
 17. *Dangerous Substance and Explosive Atmosphere Regulations 2002*.
<http://www.hse.gov.uk/spd/dsear.htm>

Solvent utilisation in industry

1. Industries Using Solvents

Adhesives	Electrical and Electronic equipment	Pharmaceutical
Boat-building	Electroplaters & metal finishing	Printing
Bookbinding	Fine chemical	Research laboratories
Chemical industry	Furniture finishing	Textile manufacture
Coatings (paints and inks)	Healthcare	Timber treatment
Construction	Mechanical Engineering	Vehicle manufacture (road, air, marine)
Cosmetics and Beauty Products	Ordnance manufacture	

2. Examples of Common Types of Solvents

Acetone	Ethyl Acetate	Iso-Propanol
Aromatic hydrocarbons (various)	Glycol Ethers	Paraffins (various)
Butanols	Methyl Ethyl Ketone (MEK)	Toluene
Cyclohexane	Methanol	Turpentine Substitute
Dichloromethane	Methyl Isobutyl Ketone (MIBK)	White Spirit
Ethanol	Naphthenic Hydrocarbons (various)	Xylene

3. Examples of Common Uses of Solvents

Catalysts	General cleaning products	Reactant carrier in chemical manufacture
Coatings	Inks	Research and teaching
Contact adhesives	Paint solvents	Solvents for Pigments and Dyes
Re-crystallisation	Pharmaceutical manufacture	Surface cleaning
Degreasing	Purification	
Dry cleaning	Resin/Polymer carriers	

Regulatory Framework / Legislation and Policy

The Groundwater Regulations 1998

The Groundwater Regulations 1998 came fully into force on 1 April 1999 and completed the transposition of the EC Groundwater Directive into United Kingdom law. The Regulations supplement the provisions of the Water Resources Act 1991 (WRA). Guidance on the implementation of the Regulations has been issued by Defra (available on <http://defraweb/environment/water/ground/guidance.htm>).

The purpose of the Regulations is to protect groundwater from pollution by certain listed substances or groups of substances. These substances are defined in Lists I and II of the Directive and the Groundwater Regulations 1998. For List I substances, which include many commonly used solvents, measures should be taken to prevent their introduction to groundwater. For List II substances measures should be taken to restrict their introduction into groundwater, so as not to cause any groundwater pollution.

In the UK it is an offence to allow a direct discharge of a List I substance to enter groundwater. Moreover, the Environment Agency may not authorise activities which might lead to an indirect discharge of a List I substance except in very rare and specific circumstances. It is also an offence to allow List II substances to enter groundwater without prior investigation and authorisation (containing any necessary pollution prevention conditions) by the Agency. Any disposals, or tipping for the purpose of disposal, to land of listed substances similarly require prior investigation and authorisation by the Agency.

A variety of activities utilise List I and II substances, but do not make deliberate discharges to the environment. Such activities do not normally require an authorisation under the Groundwater Regulations. Nevertheless, these activities could result in a non-deliberate or accidental discharge. Regulation 19 provides the Environment Agency with powers to serve notices ('Groundwater Notices') to control any activity which might lead to an indirect discharge of any substance in List I or the pollution of groundwater as a result of an indirect discharge of any substance in List II. These notices can either prohibit the activity or impose conditions under which the activity can be carried out. Failure to comply with such a notice is an offence under Section 85 of the WRA.

The storage, use and movement of solvents are activities which might lead to an indirect discharge of a listed substance into groundwater. Therefore, they are subject to control under Regulation 19 of the Groundwater Regulations.

Regulation 21 of the Groundwater Regulations allows ministers to approve codes of practice giving practical guidance to persons engaged in any activity, which could lead to indirect discharge of certain polluting substances into groundwater.

In considering whether to issue a notice, the Agency would take account of this code of practice, having regard to individual site circumstances, and whether or not the code is being or likely to be, complied with. On this basis, therefore, compliance with the code should normally be of assistance in ensuring that the Agency does not need to issue a prohibition notice. However, the fact that the code is being followed does not mean that a notice cannot be served, and would not be a defence in respect of the provisions in the Regulations derived from Section 85 of the

WRA. For example, a notice with conditions might be required where an activity involving listed substances is in a sensitive location, or where inherent risks need to be managed through conditions designed to prevent groundwater pollution.

The Environment Agency, as regulator under the Groundwater Regulations, has published a "Policy and Practice for the Protection of Groundwater 1998". This document presents a basis for making a risk-based decision for the protection of both the quality and quantity of groundwater resources. The Policy and annexes are supported by groundwater vulnerability maps which are available from the Stationery Office, and source protection zones (SPZs) which are available on www.environment-agency.gov.uk

Additionally, Section 161A of the WRA confers powers to serve "works notices" where it considers water pollution to be likely to occur or to have occurred. The contents of these notices are prescribed in the Anti-Pollution (Works) Regulations 1999. The person on whom the notice is served might be required to carry out specific preventative or remedial works.

Other Environmental Legislation

In addition to general health and safety, and environment protection legislation, more specific legislation which could be applicable to solvents includes, at the time of issue of this code:

Water Resources Act 1991 (1991 c. 57)

The Environment Agency has a duty under this Act to protect the quality of controlled waters, which include groundwater, and conserve their use for water resources. It is an offence to cause or knowingly permit any poisonous, noxious or polluting matter to enter controlled waters (including both groundwater and surface water). A consent to discharge is required if discharges to controlled waters are required. Any breach of the Groundwater Regulations 1998 (see above) is an offence under this Act.

Anti-Pollution (Works) Regulations 1999 (1999/1006)

These Regulations determine the content and procedure for works notices served by the Environment Agency on a person causing or knowingly permitting pollution of controlled waters requiring them to remediate the problem, or to take action to prevent likely future pollution. Alternatively, the Environment Agency may, under the Water Resources Act 1991, carry out such works itself and recover the costs from the liable party.

The Water Industry Act 1991 (1991 c. 56)

This Act relates to the supply of water and the provision of sewerage services, including the consenting of trade effluent and special category effluent.

Environmental Protection Act 1990 (1990 c. 43)

Part II. Provides a framework for waste management in the UK and applies to 'controlled wastes', which include household, industrial and commercial wastes. It also covers 'special waste'. This part of the Environmental Protection Act also brings in the Duty of Care for producers and handlers of waste.

Part IIA. Requires remediation of land which is identified as Contaminated Land on the basis of substances in or under the land causing water pollution or significant harm to the health of humans and other living organisms, or to ecosystems or property. The provisions typically apply to land which has been contaminated by substances (including solvents) and is not suitable for its current use by virtue of these substances.

Pollution Prevention and Control Act 1991 (1991 c. 24)

Environmental Protection (Prescribed Processes and Substances) Regulations 1991 (1991/472) and the Pollution Prevention and Control (England and Wales) Regulations 2000 (2000/1973)

Industrial pollution has been controlled through the Environmental Protection Regulations established by the Environmental Protection Act 1990, and referred to as Integrated Pollution Control ('IPC'). IPC is being superseded by the Pollution Prevention and Control ('PPC') Regulations on a sector-by-sector basis, concluding in 2007. The PPC Regulations transpose the Integrated Pollution Prevention and Control Directive (EC/96/61) and also include industrial activities that were covered by IPC but not the Directive. PPC aims to control pollution through a system of permitting and the concept of Best Available Techniques. Conditions are set in authorisations/permits by the regulator to protect the environment as a whole. PPC builds upon the experiences of IPC, extending to a wider range of environmental considerations.

Waste Management Licensing Regulation 1994 (1994/1056)

If there is a Waste Management Licence in force, Regulation 15 of the Waste Management Licensing Regulations 1994 apply instead of the Groundwater Regulations.

Environmental Protection (Duty of Care) Regulations 1991 (1991/2839)

The Environmental Protection Act 1990 (see above) places responsibility on any person who handles controlled waste to exercise a duty of care. The 1991 Regulations provide that when the waste is transferred off-site, signed transfer notes are completed and retained.

Special Waste Regulations 1996 (1996/972)

Defines wastes which are hazardous (termed 'special' in the UK) and outlines requirements for their disposal. Only sites licensed to accept special wastes must be used and the Environment Agency must be notified of any transfer of special waste. Special waste must be accompanied by completed special waste transfer documentation (Consignment Notes).

The Waste Incineration (England and Wales) Regulations 2002 (2002/2980)

The Waste Incineration Regulations came into force on 28 December 2002 and implement the Waste Incineration Directive (2000/76/EC) through the Integrated Pollution Prevention and Control regime. The effect of the Directive is to rationalise existing legislation relating to waste incineration.

Control of Major Accident Hazard Regulations 1999 (1999/743)

These Regulations apply to sites that have the potential to cause major accidents as they use or store significant quantities of dangerous substances (oils, gas, chemicals or explosives). The Regulations require that the operator shall take all measures necessary to prevent major accidents and limit the consequences to persons and the environment.

The Public Health Act 1961

The Notification of Installations Handling Hazardous Substances Regulations 1982 (1982/1357)

The Carriage of Dangerous Goods by Road Regulations 1996 (1996/2095)

These regulations impose prohibitions on and requirements for the carriage of dangerous goods by road in a container or vehicle in bulk, or in a tank and impose duties in the event of accidents and emergencies.

The EC Solvents Emissions Directive (99/13/EC) (SED)

The purpose of the SED is to prevent or reduce the direct and indirect effects of emissions of volatile organic compounds (VOCs) into the environment, mainly into air, and the potential risks to human health. It aims to achieve this by providing measures and procedures for certain activities operating above defined solvent consumption thresholds. The Directive was initially largely implemented by two Solvent Emissions Directions issued to regulators in 2002 requiring them to include conditions in EPA or PPC permits to meet the Directive's requirements, and by the Carriage of Dangerous Goods by Road Regulations 1996. The main implementing legislation for industrial activities is now the Solvent Emissions (England and Wales) Regulations 2004 (2004/107) which have superseded one of the directions and will supersede the other in October 2007. Guidance can be found at <http://defra.gov.uk/environment/airquality/lapc/pdf/sed-intro.pdf>

Glossary

Bund	A form of engineered secondary containment system with walls and floors impermeable to the material stored
Containment	Limiting the extent a leak or spill or other loss of a substance can travel
Environmental Management System	Such a system includes: establishing and implementing an environmental policy; routinely checking operations, training and emergency procedures to ensure implementation of the policy; taking any necessary corrective action; ensuring periodic review of the policy
Foul water drain	A drain carrying contaminated water to a designated and consented sewage treatment system
Groundwater	All water below the subsurface of the ground in the saturation zone and in direct contact with ground or subsoil. This is the definition used in the Groundwater Directive and Groundwater Regulations.
IBC	Intermediate bulk containers
Impermeable	Not permitting fluids to pass through. In the context of this code, it is implicit that the relevant surface should be impermeable to the substance(s) stored
Separator	A device for separating out lighter than water fractions (e.g. oils) from waste waters. This term is now used in preference to the term "interceptor"
List I substances	The most harmful and polluting substances selected on the basis of their toxicity, persistence and bioaccumulation (List I is defined in the Schedule to the Groundwater Regulations 1998).
List II substances	Substances which are less harmful (than those on List I) but are still harmful and polluting (List II is defined in the Schedule to the Groundwater Regulations 1998).
PIRP	Pollution Incident Response Plan
SDS	A safety data sheet which should be provided by solvent product suppliers
Secondary Containment	A system to contain leaks from a container or containers
Soakaway	A permeable area of ground, or a buried structure designed to speed the drainage of water into the ground.
Solvent	A substance designed to act upon other substances as a dissolver, disperser, degreaser, viscosity adjuster, surface tension adjuster, preserver or plasticiser.
SUDS	Sustainable drainage system
Sump	A sealed hole or low area into which liquid drains but that it cannot escape from.
Surface water drain	A drain which discharges into local rivers, streams or soakaways, usually with no treatment.

PB 9849

**Nobel House
17 Smith Square
London SW1P 3JR**

www.defra.gov.uk

