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HM Government

Fire and Rescue Manual

Volume 2

Fire Service Operations

Environmental Protection

2008

Fire Service Manual

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Environmental Protection

Version 1
2008

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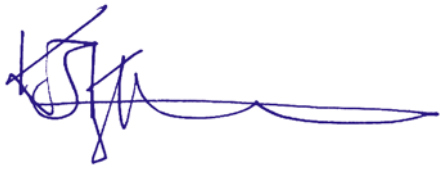
Preface

This Fire and Rescue Service manual is the first dedicated to the protection of the environment. The information and guidance provided in this publication is designed to support firefighters, managers and trainers in their work at operational incidents, training events and during day-to-day activities within the fire and rescue services.

The manual provides technical, scientific, legal and practical advice on how, when and where to consider environmental impact. I am confident that as this manual becomes embedded within the fire and rescue service the impact of Operational Incidents on the environment will reduce significantly. This manual would not have been produced without the support of the three UK environment agencies, for which I would like to express my appreciation and that of the Service as a whole.



Sir Ken Knight CBE QFSM DL
Chief Fire and Rescue Adviser

Foreword

The partnership between the Fire and Rescue Service, The Environment Agency, Scottish Environment Protection Agency and the Northern Ireland Environment Agency has developed into an extremely successful working relationship, delivering benefits to all the partner organisations and more importantly to the environment.

By working together we provide an effective response to prevent or minimise the environmental impact of thousands of pollution incidents every year. This has protected water supplies as well as minimising the disruption to recreational activities such as angling. Our working relationship during flooding events continues to grow helping to reduce or mitigate the impacts upon the communities affected by these events.

This manual will provide all firefighters with the essential knowledge required to understand how their actions both individually and collectively can safeguard the environment, whilst at the same time undertaking their principal role of saving life.

I am delighted to have been able to support the development of this manual. I hope that many will use it to learn more about the practical ways they can help protect the environment and create a better place.

Dr Paul Leinster
Chief Executive
Environment Agency

Contents

Chapter 1

Introduction to environmental protection

1.1 Purpose

This Fire and Rescue Service (FRS) manual is the first dedicated to the protection of the natural environment. The knowledge and understanding of environmental issues gathered by operational fire personnel has progressed significantly over the last decade or so. This increased awareness has been, in part, due to a successful partnership following the signing of a memorandum of understanding or emergency protocols between environment agencies and the FRSs. This has provided improvements in pollution response at an increasing number of operational incidents where successful intervention has resulted. Other working agreements with organisations such as the Highways Agency have also contributed to the success of the initiative.

Note
The term 'environment agencies' includes the Environment Agency (England and Wales), the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA).

This manual does not specifically consider the impacts that climate change will have on the FRS as this is currently being looked at by Communities and Local Government and the Chief Fire Officers Association. It will however, by providing guidance to FRSs on preventing and if necessary dealing with incidents with the potential to pollute, ensure that FRSs are in a better position to respond to any increase in pollution incidents that result from its impacts. For example, an increased risk of flooding at sites storing hazardous materials.

The manual also provides guidance to FRSs on how to prevent pollution from their own premises. By implementing this guidance FRSs can help minimise their own impacts on the environment, including those caused by emission of greenhouse gases.

This manual has been designed and written to contribute further to the 'partnership' approach adopted by UK environment agencies and FRSs. The aim of the partnership and this manual is to encourage the protection of the environment at emergency incidents, during training events and as part of day-to-day management of FRS premises and activities.

1.1.1 Philosophy

'Sustainable development' is a term used to describe society's strategy to improve the quality of life for everyone, now and for the future. The European Community (EC) Treaty, Article 6, promotes sustainable development (EC 1992) and is supported by the United Kingdom Government. This is achieved by the dynamic promotion of the Agenda 21 initiative. Agenda 21 encourages local authorities to formulate vision statements, develop objectives and implement action plans to progress sustainable development. A widely used international definition of this approach is:

> *'Development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.*

To achieve this aim, society must act in an environmentally conscientious way, in all aspects of living. Although the idea is simple, the task is substantial. It means meeting four objectives at the same time, in the UK and the world as a whole:

- Social progress which recognises the needs of everyone
- Effective protection of the environment
- Prudent use of natural resources
- Maintenance of high and stable levels of economic growth and employment.

Should society ignore the need to develop in a sustainable way, the bottom line is the breakdown of society itself through the destruction or contamination of the earth's natural resources, such as water, air, land, etc, with the consequential disappearance of species including mankind. Protecting the natural environment can be economically effective. Saving or reducing the amount of the earth's natural resources used or consumed is effective in terms of fuel and energy costs. Additionally, society benefits as a result of a cleaner, healthier, more diverse, and pleasant environment to live in. Within a quality environment, society will prosper to the benefit of this and future generations.

By being environmentally conscientious, the UK FRS can set an example to society through local communities. For a public organisation, this is not only expected but also required by central and local government directives. FRSs can achieve environmental good practice in three distinct areas of its activities.

(1) AT EMERGENCY INCIDENTS

FRS intervention can significantly reduce the impact that spillages or firewater run-off containing environmentally damaging materials may have on the environment. Such actions can provide public health benefits. Public drinking water is drawn from rivers, lakes, lochs and groundwater; FRS activities to protect these waters will help safeguard public and private drinking water supplies and consequently public health (see Figure 1.1). FRS pollution prevention and control activities can therefore be associated with the FRS's stated aim of protecting public safety. This philosophy should be borne in mind by FRS planners and Incident Commanders when prioritising

environmental protection as an objective within their strategic, systematic and placed on FRSs to consider the environment within FRS legislation and the integrated risk management process or equivalent (see Chapter 2).

There are also significant cost benefits to the UK when FRS personnel implement environmental first aid measures such as sealing a leak, blocking a drain or using a 'controlled burn' strategy. It is quite simply more expensive to clean up pollution from the environment than from a reservoir of containment provided by the FRS.

The issue of air pollution and the 'fall-out' onto land and water is considered later in this manual (see Section 3.6, Controlled burn and Section 1.3.4, Pollution prevention and legal controls).

Figure 1.1

Protection of public health by preventing contamination of drinking water supplies is of significant concern to the FRS at emergency incidents and underpins the philosophy behind operational pollution prevention and control activities.

(2) TRAINING EVENTS

It is essential that during FRS training events a balance between realism and risk is achieved. Some training events, either at fire stations or at external venues, may give rise to water or air pollution. Examples include pollution from training with firefighting foam or real fire simulators. Where there is a risk of such pollution, training organisers should not only consider the risk to the environment but also possible breaches of environmental law as part of their risk assessment process. This is discussed further In Section 2.9, End of life Vehicle, Section 3.7, Firefighting foam and Section 4.5, Pollution from FRS premises.

Figure 1.2

Photo credit – East Sussex Fire and Rescue Service

A typical firefighting foam training event. There is potential to pollute the environment and breach environmental legislation at such training events. Risks to the environment should therefore be included with training risk assessments.

(3) MANAGEMENT OF FRS PREMISES AND ACTIVITIES

Many aspects of a FRS day-to-day activity have implications for a sustainable society. These might include use of paper, energy conservation, vehicle use, management of waste and many other activities. Considering such issues as part of an environmental management system (EMS) makes for economic, social and environmental best practice. Chapter 4 provides further guidance on EMSs.

Figure 1.3

Photo credit – Oxfordshire Fire & Rescue Service

FRS day-to-day activities have the potential to pollute the environment. Vehicle workshops are an example of an FRS premise where activities that pose a risk to the environment take place and should be prioritised for environmental risk assessment (also see Chapter 4).

Note
Although this manual focuses on high environmental risk activities at operational incidents, advice and guidance on training and support activities is provided and is expected to be developed further in the future. This may be achieved by additions to this or existing FRS manuals. Any new or revised manuals will include environmental information where relevant.

1.2 Ecology and environmental science

This section outlines some basic concepts of environmental science, pollution studies and ecology relevant to FRS personnel. A basic understanding of these subjects and their interrelationships will provide FRS personnel with some of the tools necessary to prioritise environmental protection activities effectively.

1.2.1 Environmental science

The following are three relevant underlying natural laws of physics: the law of the conservation of matter; the first law of thermodynamics; the second law of thermodynamics.

WHERE IS 'AWAY'?
The law of the conservation of matter states that no atoms are created or destroyed; there is therefore no such thing or place as 'away' (Dr Anne Miller 2001). Consequently, when waste is thrown, flushed, washed or otherwise taken 'away', it merely ends up at another location. FRS personnel responsible for dealing with energy and waste including waste produced at incidents need to understand and consider this basic concept.

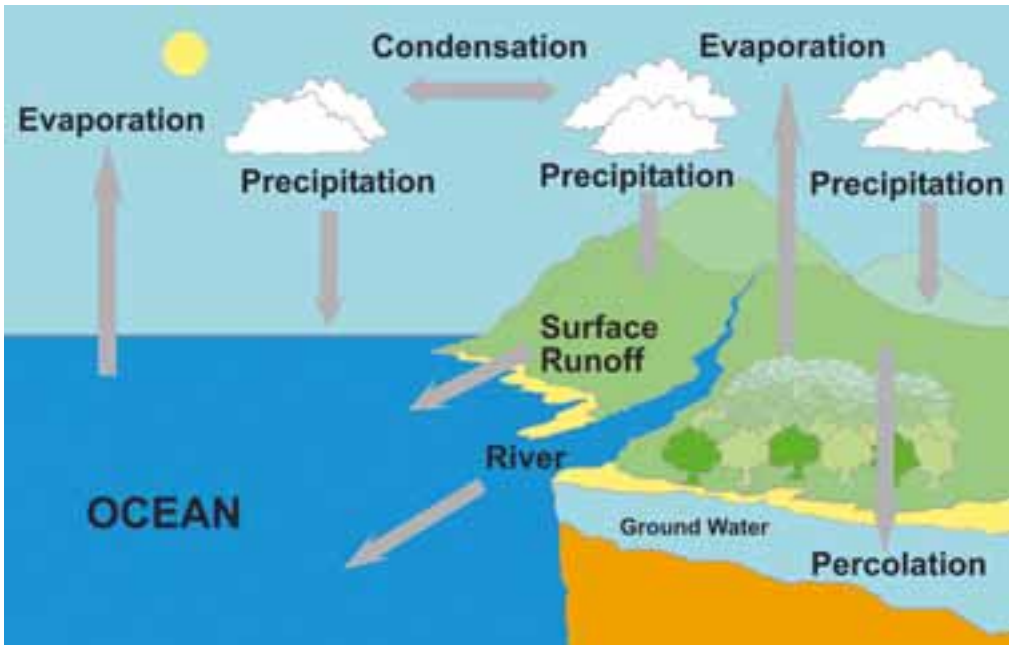
On a global scale, material continually cycles around the global system – this is known as *biogeochemical cycling*. Figures 1.4 and 1.5 show how water and carbon move around the globe. If pollution of the water or air environments occurs in one part of the world, it can have effects on others. Examples include acid rain, ozone depletion and concentrations of chemicals such as polychlorinated biphenyls (PCBs) in the environment.

Understanding these concepts will provide FRS personnel with the knowledge to consider the longer-term and broader effects of the pollution of water, land and air.

Additionally, to allow us to understand the mechanics of pollution, it is essential that the laws of thermodynamics are considered.

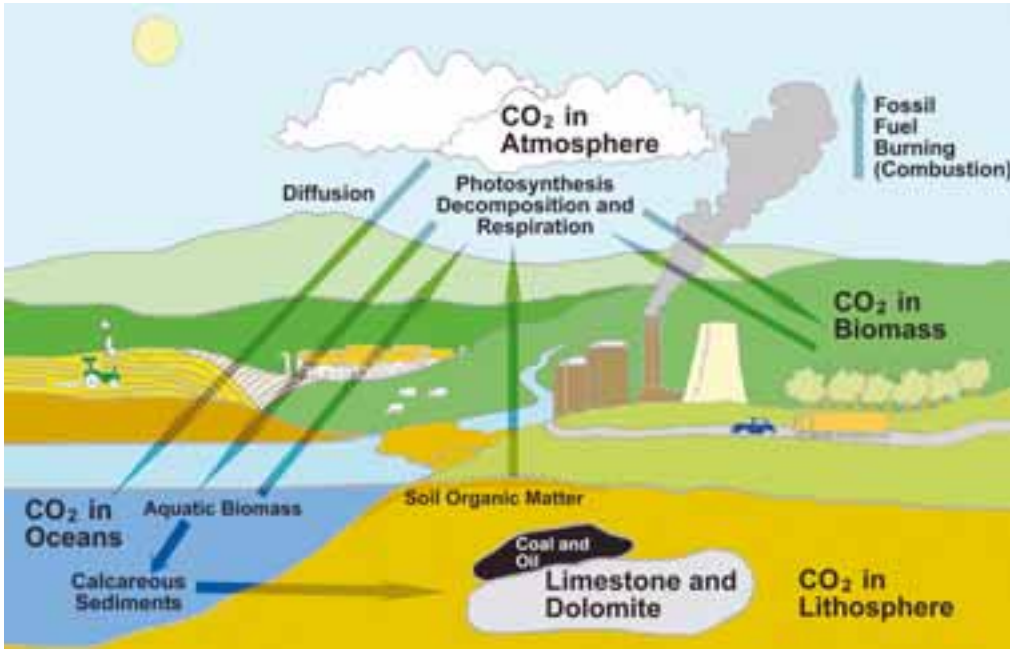
The first law of thermodynamics is that energy can be changed from one form to another but it cannot be created or destroyed. Therefore total energy remains constant.

Figure 1.4 The water cycle



Pollutants discharged into the water environment in one country can migrate to others via rivers, groundwater and the oceans.

Figure 1.5 The carbon cycle



Carbon discharged into the atmosphere in the form of CO_2 will cause a range of impacts worldwide. These include global warming.

The second law of thermodynamics is that energy always moves from highly organised to more chaotic states. This is called entropy (entropy is a measure of this disorder). Once energy has degraded to a low-quality, disorganised state, for example, as waste or pollution, a lot of extra high-quality energy is required to upgrade it to a useable form.

So if waste or pollution is created it will always take a lot more energy to clear it up once it becomes 'disorganised' and dispersed than if it can be contained and treated when it is still in one place; for instance, contained on a roadway rather than dispersed in a ditch or river. This is the basic principle behind the hierarchy of pollution control (see Section 3.2, Environmental protection operational strategies and techniques).

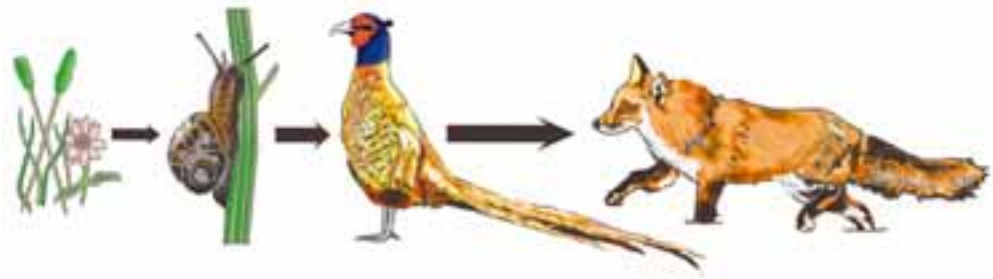
1.2.2 Ecology

The relationship between plants, animals and the environment is called ecology. Each food chain is a linked series of living things, each of which is the food for the next in line in the chain (see Figure 1.6).

Ecosystems consist of a number of species within trophic levels. Typically these consist of:

- Producers
- Primary consumers
- Secondary consumers
- Tertiary consumers
- Detritivores.

Figure 1.6



Components of a simple food chain. Pollution may destroy one or more components of a food chain causing species higher up the food chain to starve and/or species lower down the food chain to overpopulate.

PRODUCERS

These are mainly plants with some bacteria and protists (eg Protozea), which produce their own nutrients using sunlight energy and simple compounds such as carbon dioxide, water and small amounts of various minerals. They are the powerhouses of all living systems and should these organisms, which are sensitive to pollutants, be eliminated, everything else in the water environment would starve.

CONSUMERS

Primary consumers (herbivores) feed directly on living producers. Secondary consumers (carnivores) feed on living primary consumers. Tertiary consumers (carnivores) feed on living secondary consumers. Omnivores eat everything and so may be at any of these levels.

Detritivores (decomposers) feed only on dead organisms and the waste products of living organisms, but eventually all of the producers and consumers will end up in the detritivores area. They take in complex organic materials and break them down into simpler components, some of which they use, and others which they release into the environment. Eventually these simple components will become available to be taken up again by the producers, so completing the recycle loop.

If one or more levels of the food chain (also known as trophic levels) are removed, for instance, as a result of a pollution event at an emergency incident, the whole local ecosystem may fail. Agricultural systems often involve only two levels of consumer, but in lakes and oceans there may be up to four or five levels of consumer.

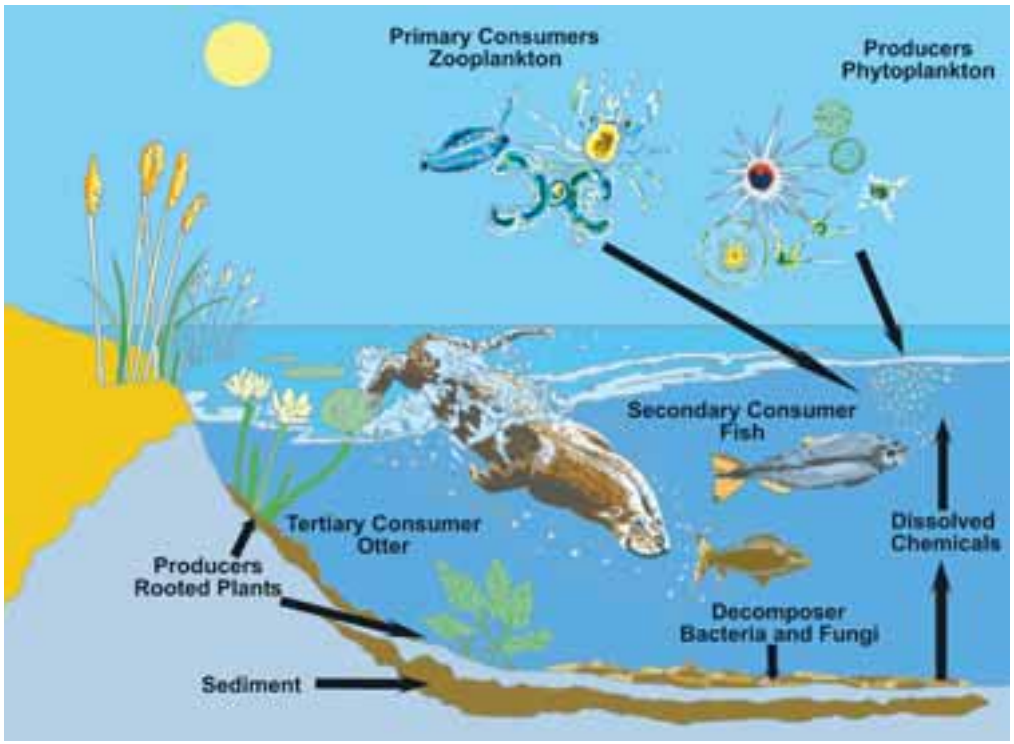
Most ecosystems are much more complicated than those described above since they contain some organisms that feed at different levels in different situations, so creating a complex web of feeding pathways instead of a simple chain.

UPTAKE OF ESSENTIAL ELEMENTS

Bacteria, protists, fungi, and simple plants like mosses and seaweeds, take in nutrients (and pollutants) all over their surfaces by simple diffusion through their cell surface membrane.

More complicated plants take in nutrients through specialised parts of their leaves and through roots. Such structures may make it easier for a plant to be selective; for example, to exclude certain unwanted substances. Animals may take in nutrients via their mouths and respiration. Some animals respire using lungs or gills and others simply breathe through their skin. All organisms can take up such substances in soluble forms making them susceptible to the effects of toxic pollutants. Figure 1.7 shows a simple aquatic food chain, although many ecosystems are more complicated.

Figure 1.7 Components of an aquatic food chain



These are far more complex in reality and can be seriously affected by pollution.

THE WATER ENVIRONMENT

All ecosystems require a supply of energy and materials. Plants within river ecosystems provide some of these but the main supply is usually from external sources; eg dead leaves dropping into the river in autumn. Organic matter has a standard pathway through such systems, as shown below.

Pathway of organic matter in river ecosystems

Organic matter (dead leaves or animals)

↓

Microbes (fungi, bacteria, protozoa)

↓

Detritivores (freshwater shrimps, water louse)

↓

Carnivores (dragonfly larvae, leeches)

WATER POLLUTION

The environment is often considered as three components: air, land and water. These, however, do not exist in isolation from each other. For example, sulphur dioxide pollution of the atmosphere can result in the acidification of lakes and rivers (see Figures 1.4 and 1.5).

The water component is often divided into sections: oceans, rivers, groundwaters, lakes, lochs, etc. Elements within the water component are also inter-linked. River pollution can lead to oceanic pollution; surface water pollution can lead to groundwater pollution and groundwater pollution to surface water pollution.

Pollutants are defined as anything that causes harm to the environment. So water pollutants include not only chemicals, oils and pathogens but also organic materials, heat and suspended solids. A list of the major categories of pollutants is provided in Table 1.1.

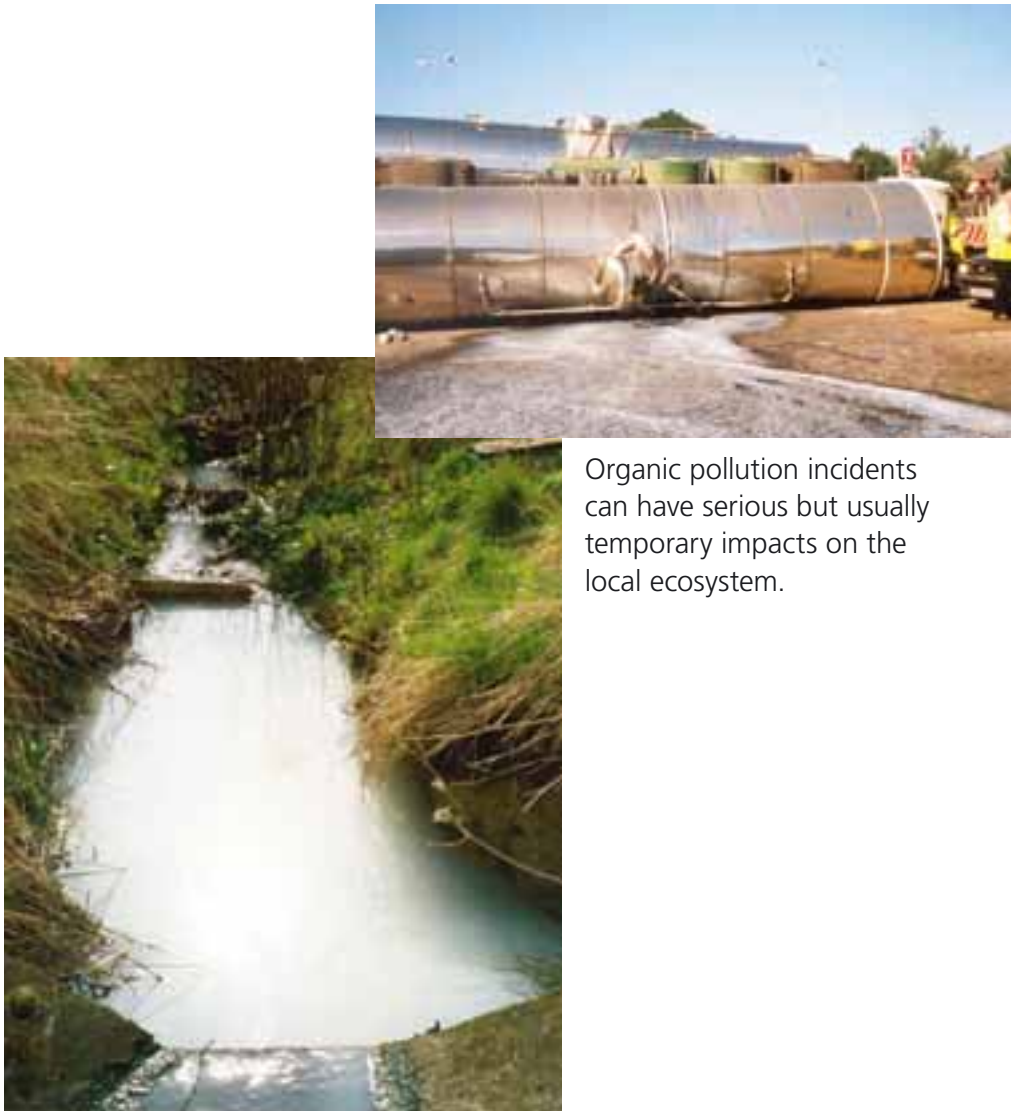
Table 1.1 Categories of pollutants

Acids and alkalis
Anions (eg sulphide, sulphite, cyanide)
Detergents
Domestic sewage and farm manures
Food processing wastes (including processes taking place on the farm)
Gases taken into solution in water (eg chlorine, ammonia)
Heat
Metals (eg cadmium, zinc, lead)
Nutrients (especially phosphates and nitrates)
Oil (mineral and vegetable) and oil dispersants
Organic chemicals (eg formaldehydes, phenols)
Pathogens
Pesticides
Polychlorinated biphenyls (PCBs)
Radionuclides
Solvents
Suspended solids, eg silts, sands etc.

ORGANIC POLLUTANTS

Not all pollutants are toxic (ie poisonous); for example, organic matter (carbon- and hydrogen-based material that can decompose; associated with living organisms). Sources of organic matter include agricultural wastes (eg slurry, silage), blood, food (eg milk, beer and orange juice, etc), sewage and many other materials. Although many of these pollutants *per se* are not toxic to aquatic organisms they can still have serious indirect consequences.

Figure 1.8 Milk tanker spillage



Organic pollution incidents can have serious but usually temporary impacts on the local ecosystem.

This is because rivers, lakes, etc are organic matter processing systems. If we add large quantities of organic matter (eg sewage or a tanker of milk or beer) this has effects that are similar to adding large quantities of dead leaves, etc except that it is finely divided (soluble) and so easy for the bacteria and fungi to consume rapidly; see Figure 1.8.

SO WHAT HAPPENS?

The microbes process the organic matter and their populations grow exponentially due to the extra food source. As the number of microbes increases they consume more and more dissolved oxygen, which leads to a reduction in dissolved oxygen levels in the water. If enough organic pollutant enters the waterbody all the dissolved oxygen will eventually be used and anaerobic conditions will arise. In such conditions most species of aquatic animals including fish will die.

If anaerobic conditions persist, for example due to a continuous discharge of sewage, specialised microbes, called 'sewage fungus', will thrive. This appears as a grey filamentous growth in the water. A smell of bad eggs will also usually be noticed. Even if anaerobic conditions do not arise some aquatic organisms may still die. This is because a number of aquatic organisms are particularly sensitive to any reduction in dissolved oxygen levels, for example, stonefly and mayfly larvae, trout and salmon.

Over time, the organic matter is used up and disperses. River water reoxygenates moving downstream as oxygen dissolves in from the atmosphere and plant growth. As the oxygen returns so does the typical fauna, although it may take some time for the ecosystem to recover fully. This illustrates the river's ability to self-purify following organic pollution.

MEASURING ORGANIC POLLUTION (BIOCHEMICAL OXYGEN DEMAND (BOD))

The 'oxygen sag' is an indirect measure of the amount of organic matter in a liquid. The BOD test is designed to quantify the amount of change imposed on the river by the entry of the particular organic substance. Therefore a measure of oxygen requirement will indicate the likely impact of an organic pollutant on the river. The *biochemical oxygen demand* (BOD) test was developed at the turn of the 20th century for this purpose.

It measures the ability of any particular organic matter in water to use up oxygen. It is carried out in standard conditions; over five days, at 20° C, in darkness. It is called the BOD 5/20 test.

The BOD test provides a standard by which organic pollutants can be compared (Table 1.2) and it is used to monitor both river pollution and the effectiveness of treatment of organic materials prior to discharge into the water environment (eg from a sewage treatment works).

Table 1.2 BOD values for different wastes/effluents

Typical BOD values	(mg oxygen/l)
Natural rivers	0.5 – 5.0
Crude sewage	200 – 800
Treated sewage	3 – 50
Poultry waste	24,000 – 67,000
Silage liquor	60,000
Dairy waste	300 – 2,000
Milk	140,000
Brewery waste	500 – 1,300
Orange juice	80,000
Paper mill effluent	100 – 400
Typical firefighting foam concentrate	50,000

Biological water quality testing methods

An assessment of the number and type of living organisms in surface water can also be used to monitor organic and other forms of pollution including heat or chemical. These assessments are referred to as biological indicators. Different organisms have different tolerances to low oxygen levels or pollutants. Using the presence or absence of particular organisms (freshwater insects, larvae and worms, visible with naked eye), water quality specialists can directly monitor the level of pollution. Basically, an ecologist (see Figure 1.9) moves across a river pushing a net over the riverbed. They then identify and count the organisms they catch in the net. The more sensitive organisms present, the better the quality of water in the river.

OTHER FORMS OF POLLUTION

Other forms of pollutants include inorganic substances, like metals and acids, and man-made organics such as pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), phenols, etc. When considering toxic substances entering a watercourse, some key terms in the science of eco-toxicology need to be considered. (see Table 1.3) When FRSs attend incidents which involve substances with these properties they should be prioritised accordingly.

Figure 1.9

Environment Agency officer undertaking biological testing of a river.

Photo credit – The Environment Agency

Table 1.3 Definition of key terms

Environmental term	Description of meaning
Persistence	Persistence of chemicals indicates that they are stable and long-lived in the environment, resisting degradation, eg lead, cadmium, mercury, PCBs, and many man-made organics
Xenobiotic	Not friendly to biological organisms in general (includes many man-made substances, especially pesticides, lead, cadmium and mercury)
Biodegradation (Biodegrading)	Breakdown of a complex chemical into (simpler) components by actions of biological organisms. Note: not always broken down into more benign components, eg the pesticide dieldrin biodegrades into photodieldrin, which is considerably more toxic
Bioconcentration	Extraction of chemicals from the environment, and concentration within the organism. For example, seaweed concentrates iodine from the seawater within its tissues, so it is very useful for humans as a source of concentrated iodine. Similarly, plutonium is present at very low levels in seawater. It is concentrated within tiny algae (phytoplankton) that make up the producers in the open sea ecosystem (up to 3,000 times stronger in one of these algae than in the sea water). Algae also concentrate PCBs to 2,000 times the ambient sea water levels
Bioaccumulation or biomagnification	Concentration of pollutant; gradient that occurs in moving from one trophic level to another, ie when an animal eats a plant or another animal

Perhaps the best-known example of a pollution event that affected humans was in the 1950s in Minemata Bay, Japan. Mercury (mercuric sulphate) was discharged untreated into Minemata Bay over a number of years where it accumulated in the sediment offshore. Here it was naturally converted into methyl mercury, a more soluble form readily taken up by plants and animals. The food chain included several different carnivorous fish and eventually humans (fishermen) who ingested 500,000 times the normal seawater concentration of mercury when they ate the fish. The local population developed various ailments relating to the poisoning and serious birth defects also occurred. This form of mercury poisoning is known as Minemata Bay disease.

1.2.3 Environmental conditions

Environmental conditions in any particular geographical area of the UK can directly influence the toxicity of pollutants in a waterbody. It is therefore useful for environmental specialists within FRSs to consider these when pollutants are released into the water environment.

Hardness: in hard water (due to high concentrations of dissolved calcium and magnesium) the toxicity of metals such as cadmium, lead or copper is reduced. Such waters will also be better able to cope with an acid spill due to better buffering capacity. However, the toxicity of other substances such as ammonia is actually increased.

Acidity: the more acidic the water, the more soluble many metals are in it, and so the more likely it is that they will enter the food chain, eg aluminium in lake water.

Temperature: high water temperatures naturally reduce dissolved oxygen levels. These conditions also encourage greater microbial growth, so the effect of an organic spill during the summer period may be more severe, although self-purification is accelerated.

Mixtures: pollutants can change their toxicity in the presence of other toxins. They may produce three possible outcomes:

- Additive toxicity
- Increased toxicity
- Decreased toxicity.

The presence of chromium, for example, can increase the toxicity of nickel ten-fold whereas the presence of strontium can decrease the toxicity of nickel three-fold.

1.2.4 Effects of pollutants

For each pollutant type, an indication of the likely effects on the immediate ecosystem can be predicted, as shown in Table 1.4.

Table 1.4 Types of pollution and their effects

Type of pollution	Effects
Suspended inorganic solids: eg silt pumped into a river	Substrates change due to the riverbed being covered with silt. Fish gills and filter feeders become blocked. The penetration of light is reduced, causing a reduction in photosynthesis, thereby reducing plant growth. Changes in the community of organisms present. A loss of diversity occurs.
Thermal pollution: eg from fire run-off water	Water body is heated. Oxygen content of the water is reduced. The capacity for self-purification is accelerated. Changes in the community of organisms present. A loss of diversity occurs.
Inorganic chemicals	Some are toxic and some cause change to acidity or alkalinity (pH) of the water. Change in the community of organisms present. A loss of diversity occurs.
Organic matter: eg milk spillage	Reduction of oxygen levels. Changes in the community of organisms present. A loss of diversity occurs.
Nitrogen and phosphates: eg fertiliser spillage	Eutrophication, producing toxic algal blooms. Blockage of drains and filters with algal mass. Changes in the community of organisms present. A loss of diversity occurs. Many fertilisers are also acutely toxic, particularly those based on ammonia.
Toxic organic chemicals	Poisonous. Changes in the community of organisms present. A loss of diversity occurs. Bioaccumulation and/or persistence possible.
Pathogens	The spread of disease. Therefore a need to remove them from drinking, bathing and recreational waters.

1.2.5 Pollution of the water environment

Pollutants released during fires or other emergency incidents, including hazardous materials (hazmats) and other spills, have the potential to pollute air, land and the water environment. However, the water environment is arguably the most vulnerable to pollution from emergency incidents. It is also the part of the environment that the FRS can protect most readily.

All living things need water to live. Rivers and lakes are fragile ecosystems that depend upon water to be non-toxic, clear and containing adequate dissolved oxygen. Importantly for humans, we all depend upon clean water for drinking water supplies, watering of livestock (see Figure 1.10), irrigation of crops, gardens and industrial use.

SURFACE WATER

Surface water is a term used to describe water contained in rivers, streams, ditches, lakes, lochs and reservoirs. As well as drinking water supplies, surface waters provide an important recreational and economic resource, eg recreational and commercial fisheries. UK government policy is to develop fisheries because they provide important social and economic benefits. Other recreational uses include canoeing, boating, walking by the rivers, etc.

GROUNDWATER

'Groundwater' is the term used to describe the water underground in areas of permeable rocks, known as aquifers. Aquifers hold at least 20 times more water than all the UK's surface reservoirs. This means that underground water is a major national resource. For example, groundwater provides 75% of public drinking water supplies in south-east England, 13% in the north of England, 5% in Wales, 3.6% in Scotland and 6% in Northern Ireland.

Figure 1.10

Photo credit – The Environment Agency

Livestock watering is one of many uses of water that can be affected by pollution.

Note
The above percentages of groundwater used for drinking water within a region will not necessarily reflect local use. For instance, for some towns or areas 100% of drinking water will come from groundwater whereas in others all will come from surface water.

Groundwater abstractions are also an important source of water for agriculture and industry and provide for people or businesses that cannot, or would rather not, use water from the public mains. Private wells are controlled by local authorites.

This water is also ecologically important. Many wetlands, lakes and rivers depend on it. Removal of groundwater can cause low river flows or for rivers to dry up completely. Reducing the quality or the quantity of groundwater can in turn impair river quality and levels and vice versa (see Figure 1.11).

Often groundwater is out of sight and therefore out of mind, but it can be vulnerable to pollution from emergency incidents. Unlike a river, once an underground water resource is polluted – eg through chemical spills or fire run-off water – it may remain contaminated for many decades and could be costly or impossible to clean up.

Water beneath and near urban areas often suffers from current or past industrial pollution from chemical works, waste sites, gas works, leaking underground tanks, drains and sewers, etc. As a result, aquifers under cities such as Birmingham and Coventry cannot be used for drinking water abstraction without expensive treatment.

Groundwater levels change throughout the year, depending on the weather and how much water is taken from the aquifers by abstraction. Groundwater is mainly replenished by winter rainfall. This process is termed ‘groundwater recharge’. Groundwater droughts occur when the amount of recharge in the winter is low.

Figure 1.11

Over abstraction of groundwater can cause rivers and lake levels to fall.

Photo credit – The Environment Agency

Dry summers with consequential increased demands for water also contribute to groundwater impact.

It is an offence to pollute groundwaters under UK and EU pollution prevention legislation (see Section 1.4, Environmental law).

INCIDENTS THAT THREATEN THE WATER ENVIRONMENT

UK FRSs deal with a variety of emergency incidents where there is often a risk of polluting the water environment. The situation might be a spillage or leak entering a drain, watercourse or seeping into the ground. The highest priority in these situations will always be public and crew safety. However, protection of public and private drinking water supplies and the environment should still be a high priority to Incident Commanders and crews.

Where fire extinguishments or precautionary actions (such as applying a foam blanket to reduce vapour emission) are taken, it may be the FRS actions that are either causing the pollution or contributing to its severity. In these circumstances, UK environmental law requires mitigating actions to be taken by the FRS (see Section 1.4, Environmental law). Where the risk to the environment is high, Incident Commanders may decide on a course of action to reduce or eliminate environmental impact completely. Further guidance on operational tactics designed to protect the water environment is provided in Section 3.2, Environmental protection operational strategies and techniques.

The range of potentially polluting incident types is summarised in Table 1.5.

Spillages of oils and fuels are the most common source of water pollution incidents in the UK (15% of the total). Many of these pollution events are as a result of RTCs. In 2004, 34,351 serious or fatal RTCs (source www.dft.gov.uk) were recorded in England and Wales. Although it is accepted that each incident alone will not normally constitute a serious pollution incident (even though a spilt lorry fuel tank could be enough to close a public water intake), the sum total of such spillages in the UK from RTCs over a 12-month period is substantial. Consequently on every occasion that FRS crews prevent the entry of a pollutant into the environment, a contribution to the reduction in the overall impact is made. (see Figure 1.12).

The UK FRS attends around 4,000 hazmat incidents and over 200,000 fires each year (source www.statistics.gov.uk) many of which present potential and actual polluting situations to attending FRS crews. This risk requires a common approach to environmental protection if the aims of the EC Treaty, Article 6, to promote sustainable development (EC 1992), are to be met.

Table 1.5 FRS incident types with the potential to pollute the aquatic environment

Incident type	Effect
Fires	Fires involving buildings, vessels, plant or materials, where firewater, contaminated with products of combustion and materials stored on site and if used, firefighting agents (such as firefighting foam) that can flow from the fire scene into drainage systems, surface or groundwater.
Road Traffic Collisions (RTC)	RTCs where the contents of vehicle fuel tanks, engine block, cooling system, braking system, steering system, suspension system, etc are likely to be released following a moderate to serious collision.
Hazmat	Incidents involving hazmats classified by the UN in the current *United Nations (UN) Recommendations on the Transport of Dangerous Goods*, known as the 'Orange Book', where toxic or harmful matter can flow into water.
Eco-toxic	Incidents involving the spillage of eco-toxic materials such as inks, dyes, detergents etc that are not classified by the UN as hazardous.
Organic	Incidents involving the spillage of organic matter such as milk, beer, blood, sewage, etc that enters the water environment.
Inorganic	Incidents involving inorganic matter such as silt, cement, sand etc that enters the water environment.

Figure 1.12

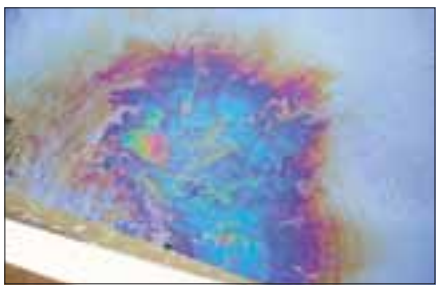


Photo credits –

i. Oxfordshire Fire & Rescue Service
ii. The Environment Agency

Leaking oil is contained on a roadway by a firefighter using a clay drain mat following a vehicle fire. However, a small quantity of oil has entered a nearby river at the outfall from the road, causing a typical iridescence. Half a litre of oil can cover an area of water equal to a football pitch.

1.3 The environment agencies

Responsibility for the protection of the environment in the UK rests with a number of different organisations at central and local government levels. The most significant of these are the three UK environment agencies. These are the Environment Agency for England and Wales, the Scottish Environment Protection Agency (SEPA) in Scotland, and the Environment Agency Northern Ireland (NIEA).

Note
These are referred to as 'environment agencies' throughout this document unless specific issues relate to individual organisations.

The three UK environment agencies were formed in April 1996 as a result of the Environment Act 1995. They have similar duties, powers and responsibilities to protect and improve the environment, although there are some differences between the areas of the UK with regard to flood risk management works, radiation licensing, fisheries, waste regulation, discharges of pollution from industry and water quality.

1.3.1 Water resources – quantity

With regard to water resources (quantity), the environment agencies are responsible for the conservation, redistribution and augmentation of surface and groundwater supplies. They have powers to encourage water conservation and to promote transfer schemes. They aim to balance the needs of water users and the environment by issuing licences for water abstraction from rivers and groundwater (see Figure 1.13).

Figure 1.13

A typical water abstraction point on an inland waterway. Environment agencies are responsible for issuing licences for abstraction from rivers and groundwater.

1.3.2 Flood risk management

In England and Wales the Environment Agency and in Northern Ireland the Rivers Agency, Department of Agriculture are responsible for protecting people and the built environment from flooding by providing effective defence and protection of property. This includes flood warning, operating and maintaining river structures and promoting works that are sustainable and work with nature. In Scotland, SEPA provides the flood warning service and advice while the local authorities are responsible for providing flood defence and protection of property (see Figure 1.14).

Figure 1.14

Photo credit – Cumbria Fire and Rescue Service

Fire and Rescue Services work with environment agencies during planning or response phases of flooding incidents.

1.3.3 Fisheries, recreation and conservation

In England and Wales, the Environment Agency, in Scotland the Scottish Executive and in Northern Ireland the Department of Culture, Arts and Leisure (Inland Fisheries) have responsibility for maintaining and improving fisheries, both game and coarse. This is carried out by licensing, regulation, enforcement schemes, improvements to fisheries and habitat, fish stocking and by providing advice to fisheries owners. The environment agencies also have a general duty to promote the recreational use of water and land. In fulfilling these functions, there is a requirement to contribute to the conservation of nature, landscape and archaeological heritage.

1.3.4 Pollution prevention and legal controls

The pollution control function and regulation by environment agencies have a number of facets.

Figure 1.15

Photo credit – The Environment Agency

Fisheries are a valuable and popular resource that are continually being improved by environment agencies.

WASTE

The agencies are responsible for setting consistent standards for waste management practice to regulate the treatment, storage and movement of controlled waste, for example, by permitting landfill sites (see Figure 1.16). The agencies also register and monitor those who produce waste, imposing obligation to reuse, recover or recycle products and materials. They also regulate the management and remediation of contaminated land designated as special sites. The agencies are not responsible for the collection and disposal of waste and will only act to do so when all other routes have been exhausted or in an emergency where people and/or the environment are at risk (see also Section 3.8, Hazardous waste).

Figure 1.16

Photo credit – The Environment Agency

Environment agencies are responsible for the regulation of waste in the UK.

INDUSTRIAL SITES

The Environment Agency regulates industrial sites prescribed as 'Part A (A (1)) Process' in England and Wales under the Environment Permitting Regulations 2007. SEPA and NIEA regulate 'Part A' Processes in Scotland and Northern Ireland under the Pollution Prevention and Control Regulations 1999 and associated regulations. These sites are the most polluting or technologically complex industrial processes, eg large power stations and chemical complexes and their regulation covers any discharge made to land, air or water, as well as other environmental considerations such as waste. The environment agencies also advise the Government and local authorities on air quality. In Scotland and Northern Ireland the environment agencies also regulate Part B processes. These are normally smaller sites and are mainly concerned with emissions to air. In England and Wales local authorities undertake this role.

SMOKE FROM FIRES

The environment agencies are not responsible for the impact of smoke within the environment from a fire or fire training. This duty rests with environmental health departments in local authorities.

The environment agencies will seek to minimise the likelihood of a fire at sites they regulate by setting conditions relating to accidents as part of the operator's permit. This could include for instance, fire sprinklers. If a fire should occur they may also be able to provide the FRS and other responders details of products and processes at the site and their likely environmental impact.

From March 2009 in the event of a major air pollution incident in England and Wales, the Environment Agency will work with the Health Protection Agency, the Meterological Office, the Health and Safety Laboratories and the Food Standards Agency to coordinate the provision of air quality data to the Health Protection Agency and Gold Command. This information will ensure appropriate intervention can be taken by emergency services and meaningful messages provided to the public via the media.

FRSs should contact their local Environment Agency office for further details.

RADIOACTIVE SUBSTANCES

The environment agencies are responsible for regulating the disposal and accumulation of radioactive waste, including that from nuclear licensed sites. The environment agencies also regulate the keeping and use of radioactive materials, except on nuclear licensed sites.

WATER QUALITY AND POLLUTION CONTROL

The agencies are responsible for the prevention and control of pollution to 'controlled waters', or in Scotland the 'water environment', which includes all inland waters (rivers, lakes, lochs, reservoirs, canals, groundwaters and dry ditches as they might contain water in wet conditions), estuaries and coastal waters to three miles. They do this by regulating discharges, into controlled waters monitoring, undertaking water quality pollution prevention initiatives and responding to

incidents. The environment agencies and FRS partnerships in England and Wales, Scotland and Northern Ireland form a key element in the strategy to control pollution and maintain and improve water quality.

1.3.5 Role of local authorities

The agencies do not cover all aspects of environmental legislation and services to the public. Local authorities are responsible for most complaints associated with noise, litter, fly-tipping (see Figure 1.17), odour (except from permitted/ licensed landfill sites) and air pollution arising from vehicles, household areas, small business and industries. They also have responsibility for planning, environmental health and work on contaminated land with the agencies. However, the environment agencies do have responsibility for noise and air pollution from larger and/or more complex industrial sites and processes (see Section 1.3.4).

Figure 1.17

Photo credit – The Environment Agency

Local authorities and the land owner have responsibility for dealing with fly-tipped materials. However, environment agencies should be notified of Incidents involving fly-tipping if there is a risk of pollution and/or criminal activity is suspected.

1.4 Environmental law

1.4.1 Legal background

At emergency incidents involving potentially polluting situations Incident Commanders must be aware of the legal implications of FRS actions, the duties that environmental legislation places on them and the defences available. This is because the FRS could potentially be prosecuted and/or be liable for clean-up costs if it can be proved they have caused or exacerbated pollution.

Table 1.6 provides a summary of environmental legislation relevant to the FRS at operational incidents for England, Wales, Scotland and Northern Ireland.

FRS managers also need to consider environmental legislation when polluting materials are stored or used at FRS premises. This includes waste (see Section 3.8, Hazardous waste and Section 4.6, Pollution from FRS premises) and the use of firefighting foam during training (see Section 3.7, Firefighting foam).

Although the amount of UK environmental legislation is substantial, much of it is of only remote relevance to FRS Incident Commanders. Incident Commanders therefore need only familiarise themselves with the general requirements of four areas of environmental law:

1 Surface, and coastal waters and ground waters

2 Sewerage systems

3 Groundwater and land

4 Waste legislation, and in particular hazardous waste.

This relevant environmental legislation has been produced to comply with European Directives and/or to ensure national and EU water quality standards are met. All have the aim of improving or maintaining water quality by preventing or controlling pollution. Hazardous waste legislation additionally aims to protect public safety.

1.4.2 Surface water protection

In England and Wales, Sections 85–89 of the Water Resources Act 1991 cover offences relating to polluting controlled waters and are enforced by the Environment Agency.

Section 85 provides:

'A person contravenes this section if he causes or knowingly permits any poisonous, noxious or polluting matter or any solid waste matter to enter any controlled waters.

Note
"Causing" must involve some active operation or the failure to take action (eg maintenance) or chain of operations resulting in the pollution whether the person or organisation knew of the pollution at the time or not. Whereas "knowingly permitting" involves a failure to prevent the pollution, which must be accompanied by knowledge.

On summary conviction in a magistrates court, to imprisonment for a term not exceeding three months or to a fine not exceeding £20,000 or to both;

On conviction on indictment in a crown court, to imprisonment for a term not exceeding two years or to a (unlimited) fine or to both. Any such offence is an absolute offence that can involve one or more parties.'

Table 1.6 Four areas of relevant environmental law

	Country	Title of Statutory Instrument	Area of Control
1	England and Wales	The Water Resources Act 1991	Surface, ground and coastal waters – three miles
	Northern Ireland	The Water (Northern Ireland) Order 1999	
	Scotland	Water Environment (controlled Activities) (Scotland) Regulations 2005	Note: These are deemed controlled waters in England, Wales and Northern Ireland. In Scotland The Water Environment
2	England and Wales	The Water Industry Act 1999	Sewerage systems
	Northern Ireland	The Waste and Sewerage Services (NI) Order 1973	
	Scotland	Sewerage (Scotland) Act 1968 as amended	
3	England and Wales	The Groundwater Regulations 1998	Groundwater and land/soil
	Northern Ireland	The Groundwater Regulations 1998	
	Scotland	Water Environment (Controlled Activities) (Scotland) Regulations 2005	
4	England and Wales	The Hazardous Waste Regulations 2005	Hazardous Waste
	Northern Ireland	The Hazardous Waste Regulations 2005	(see Section 3.8)
	Scotland	The Special Waste Regulations 1996, as amended	

In Scotland, SEPA enforces The Water Environment (Controlled Activities) (Scotland) Regulations 2005. This Act provides for controls on activities liable to cause pollution of the water environment (ie rivers, lochs, coastal waters, groundwater) and its aims are similar to the Water Resources Act 1991.

In Northern Ireland a unit within the NIEA called the Water Management Unit enforces The Water (Northern Ireland) Order 1999. The 1999 Order is a key piece of legislation for controlling pollution of water in Northern Ireland. The main differences are that in Regulation 9(1) underground strata are included and impeding the flow of water in a manner likely to cause pollution is also an offence.

1.4.3 Defences

The Water Resources Act (England & Wales) provides a defence, based on three criteria, all of which must be in place for the defence to succeed. They are if:

'(1) The entry is caused or permitted, or the discharge is made in any emergency in order to avoid danger to life or health;

(2) That person takes all steps as are reasonably practicable in the circumstances for minimising the extent of the entry or discharge and of its polluting effects; and

(3) Particulars of the entry or discharge are furnished to the Environment Agency as soon as reasonably practicable after the entry occurs.'

As in the case of offences, the defences in the Northern Ireland Order are partly different.

'It shall be a defence to prove that he exercised all reasonable care to prevent the discharge or deposit of the matter in question.'

In Scotland, defences are detailed in Regulation 44 of the Water Environment (Controlled Activities) (Scotland) Regulations 2005. There is a defence where the contravention is a result of:

'(a) –

(i) an accident which could not reasonably have been foreseen; or

(ii) natural causes or force majeure which are exceptional and could not reasonably have been foreseen; and

(b) –

(i) all practicable steps are taken to prevent deterioration of the water environment;

(ii) all practicable steps are taken as soon as is reasonably practicable to restore the water environment to its condition prior to the contravention; and

(iii) particulars of the contravention are furnished to SEPA as soon as practicable after it occurs.'

1.4.4 Protection of groundwater

In England, Wales, and Northern Ireland, the Groundwater Regulations are intended to prevent unauthorised discharges of polluting matter into groundwaters. Within the scope of the Regulations, groundwater means *'all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil'*.

Pollution within the Regulations means *'the discharge by man, directly or indirectly of substances or energy into groundwater, the results of which are such as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with legitimate uses of water'*. Additionally an offence is committed if a person *'causes or knowingly permits disposal or tipping (onto land for instance) ... which might lead to an indirect discharge into groundwater'.*

In Scotland, the Water Environment (Controlled Activities) (Scotland) Regulations 2005 are intended to control or prevent polluting discharges to groundwater. The definition of groundwater is the same as above, however, the pollution definition and offences are different.

1.4.5 Sewerage and drainage system protection

It is an offence to discharge polluting material into a sewer without an appropriate consent. This is because polluting material can:

- affect the sewage treatment process at a sewage works resulting in partially treated or untreated sewage entering the water environment
- pass through a sewage treatment works unaltered and enter the water environment.

Sewage undertakers must therefore be:

- informed of all accidental discharges of polluting materials into sewers
- asked for permission before a deliberate discharge can take place, for instance to divert fire run-off water away from the water environment.

In Northern Ireland, the NIEA will ensure that the Water Service is informed about any material that will impact on the sewerage infrastructure in the event of any pollutant being introduced as part of FRS action.

1.5 Relevant Fire and Rescue Service law

In England, Wales and Northern Ireland, Part 2, 11 (2) (b) of the Fire and Rescue Services Act 2004 provides for the *'Fire and Rescue Authority to take any action it considers appropriate – (if) the event or situation is one that causes or is likely to cause harm to the environment (including the life and health of plants and animals)'*.

However, the Act does not place an explicit duty or requirement on the FRS with regard to protecting the environment. But each integrated risk management plan (IRMP) (also known as a safety improvement plan or risk reduction plan (RRP) (Wales)) should demonstrate how an FRS will take account of the built and natural environment in its wider community safety strategy.

Risk planning and the requirement to protect the environment through plans produced by risk assessment allow the FRS to approach its local environment agency contact with evidence to support local pollution prevention initiatives. The requirement to consider the environment within the IRMP, together with the strengthened commitment from the environment agencies, should ensure that FRSs play a key role in ensuring public safety through the protection of the water environment and subsequently public drinking water supplies. Further information on risk planning is included in Chapter 2.

In Scotland the Fire (Scotland) Act 2005 places a duty on Scottish FRSs to mitigate the environmental impact of the spillage or release of pollutants.

1.5.1 Civil Contingencies Act 2004

The Civil Contingencies Act 2004 and accompanying regulations and non-legislative measures aim to deliver a single framework for civil protection in the UK. Part 1 of the Act defines an emergency as *'an event or situation, which threatens serious damage to human welfare in a place in the UK, the environment of a place in the UK, or war or terrorism which threatens serious damage to the security of the UK'*.

The duties placed on both FRSs and environment agencies by the Civil Contingencies Act 2004 and the associated regulations and guidance include working together in many areas; such as emergency and incident response planning, and information sharing.

When discharging these duties in relation to events or situations that threaten serious damage to the environment, FRS managers will find it useful to consider the content of this FRS manual. In effect, by implementing aspects of this manual the FRS will discharge some of its duties under the Act.

The Act is divided into two parts:

Part 1: local arrangements for civil protection, establishing a statutory framework of roles and responsibilities for local responders – for localised emergencies.

Part 2: emergency powers, establishing a modern framework for the use of special legislative measures that might be necessary to deal with the effects of a more serious emergency – affecting a larger geographical area.

The Act divides emergency responders into Category 1 and 2 responders. Category 1 responders are those at the core of emergency response and include FRSs (although not in Northern Ireland), Maritime and Coastguard Agency and environment agencies (although not in Northern Ireland) personnel. Category 1 responders are required to:

- Assess the risks of emergencies occurring and use these to inform contingency planning
- Put in place emergency plans
- Put in place business continuity management arrangements
- Put in place arrangements to make information available to the public about civil protection matters and maintain arrangements to warn, inform and advise the public in the event of an emergency
- Share information with other responders to enhance coordination
- Cooperate with other local responders to enhance coordination and efficiency
- Provide advice and assistance to businesses and voluntary organisations about business continuity management (local authorities only).

To be deemed as an environmental emergency, under the Act, the incident must come within the following definitions:

- Contamination of land, water or air with harmful biological, chemical or radiological matter or oil
- Flooding
- Disruption or destruction to plant life or animal life.

At an *emergency*, which threatens serious damage to the environment of a place in the UK, the role of the FRS is to:

- Save life – this may include responsibility for mounting rescue and evacuation
- Protect property
- Protect the environment.

The environment agencies' role at incidents is covered in Section 3.5, Environment agencies' response to incidents.

1.5.2 Terrorist chemical, biological, radiological and nuclear incidents (CBRN)

An environment agency's role at a CBRN incident is to support and advise as part of the multi-agency response, including:

- Assessing the environmental risk by helping to identify how materials might disperse and what might be at risk

- Advising on disposal and treatment of wastes
- Advising on temporary storage sites for waste removed to allow for forensic analysis
- Identifying contractors and decontamination locations
- Notifying stakeholders
- Regulation – issuing permits and taking enforcement action where appropriate.

Note
During a terrorist-related CBRN incident environment agencies will not normally attend incidents but will provide advice either by telephone, or from silver control.

1.5.3 Clean-up and waste disposal after an incident

In general, the environment agencies will look to the landowner, site occupier/operator or polluter to clean up a site, watercourse or groundwater following an environmental incident. They will advise, wherever possible, on suitable contractors and appropriate disposal routes for any wastes generated during the incident (see Section 3.8, Hazardous waste).

Where the built or natural environment is contaminated following a pollution incident, the Government Decontamination Service can be contacted for advice on clean-up protocols.

Note
The UK Government Decontamination Service provides advice, guidance, management support and contractual arrangements to support those responsible for decontamination of the built and natural environment (www.gds.org.uk).

1.6 Drainage and sewerage systems

During emergency incidents involving fire or spillages, contaminated firewater run-off or polluting materials including hazmats may flow towards and then enter drains and drainage systems. These systems will then transport the polluting materials into streams, rivers, lakes, lochs or groundwaters, or to sewage treatment works or waste water treatment systems.

Note
Some industrial sites will have their own waste water treatment system.

To facilitate emergency pollution prevention and control strategies effectively, FRS personnel need to have obtained information about the direction and destination of drainage systems both at planning stage and during incidents. The consequence of allowing pollution unchecked into drainage systems is the direct or indirect pollution

of the water environment (see Figure 1.18). The following information is designed to provide a basic understanding of how these systems operate and their vulnerability to polluting material.

Figure 1.18

An example of a pollutant that has travelled through a drainage system to discharge into a nearby river.

Photo credit – The Environment Agency

1.6.1 Sewerage systems

Sewage is the waste water carried in sewers to the sewage treatment works. Sewerage is the network of pipes and sewers (ie sewerage system), which carry the sewage to the sewage treatment works. FRSs can utilise sewerage systems at incidents either to contain polluting material, including fire run-off water, or to divert the material to a holding facility such as a storm tank or balancing pond until it can be safely removed. Caution must be exercised when considering using foul sewers to contain polluting material as they may have storm water overflows built in and blocking the foul system could cause a direct discharge via these overflows to a watercourse. Where practicable permission to discharge polluting materials into sewers must be obtained from sewerage undertakers before the discharge takes place. Where polluting material has, either before the arrival of the FRS or during FRS intervention, unintentionally entered the sewerage system, notification to sewerage undertakers must take place.

There are three main types of sewer as detailed in Table 1.7.

Table 1.7 Types and functions of sewer

Sewer type	Function
Surface water sewers	Transport rainwater direct to the nearest river, lake or groundwater.
Foul sewers	Transport sewage to a sewage treatment works.
Combined sewers (found in urban areas)	Transport both sewage and rainwater to the sewage treatment works. During storms they may overflow into watercourses.

If contaminated water or other polluting material enters a drainage system it is important to locate a drainage plan as soon as possible, to identify the type and destination of the system. FRS crews' own local knowledge can be useful in these circumstances. Also, geographical information systems (GIS) drainage maps for surface and foul systems may be available from sewerage undertakers, environment agencies, site occupiers or highway authorities (see Figure 1.19). It may be possible for such plans to be installed into fire control or in-cab systems. More information regarding drainage plans for use during the planning process can be found in Section 2.3.5. Ideally drainage plans should be made available to personnel at the scene of a pollution event to allow judgements to be made about appropriate intervention points and tactics.

Some drainage plans may have pollution control devices, such as oil separators, shut-off valves, penstocks (see Figure 1.20), storage lagoons and balancing ponds (see Figure 1.21), etc. With permission and planning, such devices can be used by FRSs to prevent pollution to surface and groundwater and to protect sewage treatment works.

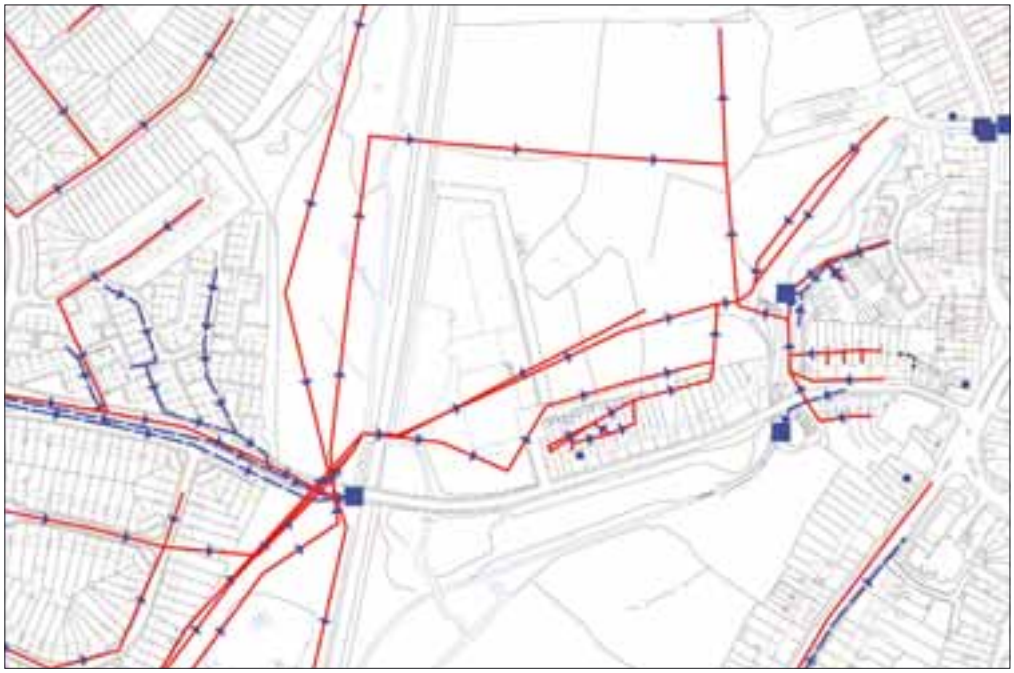
To allow emergency responders to rapidly identify drainage systems, environment agencies encourage premises occupiers to colour-code access chamber covers on their premises (see Figure 1.22). The recommended colour-coding is shown in Table 1.8.

Table 1.8 Recommended colour-coding of access chamber covers

Colour of drain cover	Type of sewer
Blue	Surface water sewer.
Red	Foul sewer.

Other sites may have other types of pipework, eg radioactive water or oily water. FRS managers may wish to consider marking drain covers at FRS premises as part of an Environmental Management System (see Chapter 4).

Figure 1.19



Picture credit – Severn Trent Water

A typical drainage plan showing the location and direction of surface and foul sewerage systems.

Figure 1.20

Penstocks can be found at a variety of locations within drainage systems.

Figure 1.21

Storage lagoons or balancing ponds which are open water ponds with controlled outlets can be used by emergency responders to contain pollutants until arrangements can be made for collection and disposal. Such facilities can be 'closed off' using penstocks, drain blockers, etc.

Figure 1.22

Photo credit – The Environment Agency

Drain covers and grills at industrial or commercial premises may be marked with colours, eg red for foul and blue for surface. FRS may wish to consider using such a system for their own premises as part of ISO 14001 systems.

1.6.2 Sewage treatment

Most industrial or commercial sites will discharge their sewage to a sewage treatment works operated by their local sewerage undertaker.

However, some sites (premises) may not be connected to a public foul sewer or have additional treatment on site. This might be because of their remote or rural location, the hazardous nature of their activities, the cost of disposal to the public sewer or because of the size of the premises or site. In such cases the occupier may use one of the methods of liquid waste treatment listed in Table 1.9.

Further details of these systems can be found in the Environment Agency's *Pollution Prevention Guidance Note PPG4* available at www.environment-agency.gov.uk.

Table 1.9 Sewerage systems

System	Works by
Cesspool	Sealed tank, no discharge; must be pumped out regularly by tanker.
Septic tank	Solids settle out in tank, liquids discharge to ground; should be emptied regularly.
Private sewage treatment plant	Small treatment plant with discharge to ground or surface water. Treats effluent on site.
Industrial treatment works	Treatment on site; usually effluent discharges to the foul sewer but may discharge to surface or groundwater.

1.6.3 The sewage treatment process

Sewage from industrial and domestic premises is normally discharged via foul or combined sewer systems to a sewage treatment works. Once at the facility the sewage is passed through a variety of physical, biological and sometimes chemical treatment processes, which remove contaminants in the sewage.

The treated sewage or effluent is then discharged either directly or indirectly into the water environment.

Although they are designed to remove pollutants, if the concentration of a pollutant in water entering a sewage treatment works is too high it can impair or destroy the biological treatment process. This can result in the pollutant and/or untreated sewage entering a receiving surface or groundwater. If the biological process has been destroyed the discharge of untreated sewage may continue for some time.

Many sewage treatment works are not staffed or staffed for only part of the day. If not fitted with warning alarms, it may be some time before it is noticed that the operation has been affected by a pollutant.

Consequently the protection of foul or combined sewer systems by FRS personnel is just as important as the protection of surface water sewers and watercourses.

An understanding of sewerage systems and how sewage treatment works operate can therefore be useful to Incident Commanders and Hazardous Materials and Environmental Protection Officers (HMEPOs) (also known as Hazmat Officers).

There are four main stages in the treatment of sewage, which can be summarised as follows:

1 Preliminary treatment

2 Primary sedimentation

3 Secondary or biological treatment

4 Tertiary treatment.

Preliminary treatment removes large solids such as rags, which could cause blockages, and sand and grit, which could cause damage due to abrasion. The main processes are screening (with or without maceration) and grit channels, which slow the flow to allow grit and sand to settle out.

After preliminary treatment, the raw sewage passes to the primary sedimentation tanks. The objective of primary sedimentation is to remove suspended solids. This is achieved by allowing the sewage to remain in the tanks for a detention period of typically six to eight hours under non-turbulent conditions. The solids, which are denser than the liquid, will settle as sludge towards the bottom of the tank (Figure 1.23).

Figure 1.23

A sedimentation tank.

Photo credit – Severn Trent Water

The partially treated effluent then undergoes secondary or biological treatment. The aim of the biological treatment processes is to oxidise the organic matter in the sewage to reduce the biochemical oxygen demand (BOD). This stage relies on the activities of micro-organisms, mainly bacteria, to break the sewage down into carbon dioxide and water using oxygen. The two main types of biological process are activated sludge, in which the micro-organisms (biomass) grow in a freely suspended form, and percolating filtration, in which the micro-organisms grow attached to a solid support such as activated carbon 'trickle beds' (see Figure 1.24). Whichever biological process is used, there must be a method for separating the biomass from the treated effluent. This generally comprises circular secondary sedimentation tanks to allow the biomass to settle out.

Figure 1.24

A biological treatment 'trickle bed'.

Tertiary treatment may be necessary at some sewage treatment works if the quality of effluent required is higher than the traditional 30mg/l suspended solids and 20mg/l BOD and/or specific quality issues need to be addressed. Examples include nutrient stripping of an effluent that discharges into eutrophic water (rich in nutrient) or disinfection of an effluent that discharges into a bathing water.

There are five basic methods of tertiary treatment:

- Prolonged settlement, eg in lagoons
- Irrigation over grassland or reed beds
- Micro-straining
- Filtration through media such as sand and gravel
- UV treatment (ie to meet bathing water quality standards).

Many sewage treatment works have storm tanks, which are designed to store excess water and sewage arriving during high rainfall. When the flows drop back to normal after the storm event, the stored sewage re-enters the treatment process at a controlled rate. Storm tanks may also be used to store polluting material produced during an emergency incident.

Figure 1.25

All sewage works discharge into the water environment. If polluting matter disrupts the sewage treatment process, there is a risk that untreated sewage and the pollutant will enter the water environment and cause pollution.

Photo credit – Severn Trent Water

Permission to intentionally discharge polluting material into foul sewers must be obtained before discharge takes place. FRSs should plan for such activities and set up systems/procedures to request permission to discharge with sewage undertakers. Sufficient time for polluting materials to be diverted to storm tanks must also be provided. Once contained at the sewage works, pollutants can be removed and taken to a waste treatment facility or 'bled' slowly into the sewage treatment system.

At incidents where hazardous material has or is likely to enter a sewerage system, it is essential that the sewerage undertaker is notified immediately. This will allow them to evacuate their own employees or contractors who may be working in a sewer downstream of the incident and to take precautionary action at the treatment works.

1.6.4 Discharge consents

Discharges from sewage treatment works into surface or groundwaters are controlled by discharge consents issued by environment agencies. It is an offence to allow any poisonous, noxious or polluting matter or any solid waste matter to enter any surface or groundwater unless the discharge is made in accordance with the conditions of consent issued by the appropriate environment agency.

It is a duty of environment agencies to determine an application for consent, either unconditionally or subject to conditions such as the nature, origin, composition, temperature, volume and rate of discharge, etc. Once consent is granted the consented discharge will be monitored to ensure compliance. Any failure to comply with the consent conditions is an offence and may result in legal action being taken by the appropriate environment agency.

1.6.5 Oil separators

Oil separators, sometimes referred to as 'interceptors', are installed within drainage systems to protect receiving waters (surface or ground) from pollution by oil or fuel. Such pollutants may be present due to minor leaks from vehicles and plant, from accidental spillages or due to deliberate and illegal tipping into drains. Oil separators are found on fuel station forecourts, at oil storage facilities, vehicle workshops, etc or fire stations with fuel dispensing facilities. These units are often identified at ground level by the presence of three inspection covers in line and in close proximity (see Figure 1.26), although single chamber models are now the preferred design. They are designed to hold back floating materials such as oils and fuels but to let clean water pass through. In Figure 1.27 the flow through a three-channel oil separator is shown.

Oil separators will only be effective if they are regularly maintained and emptied. Some installations will have an oil level alarm fitted to indicate when emptying is required. Figure 1.28 depicts a modern single-chamber separator.

Figure 1.26

The older style of oil separator can often be identified by three in-line inspection covers. Where these discharge to surface water they should be colour coded blue.

Photo credit – The Environment Agency

Figure 1.27

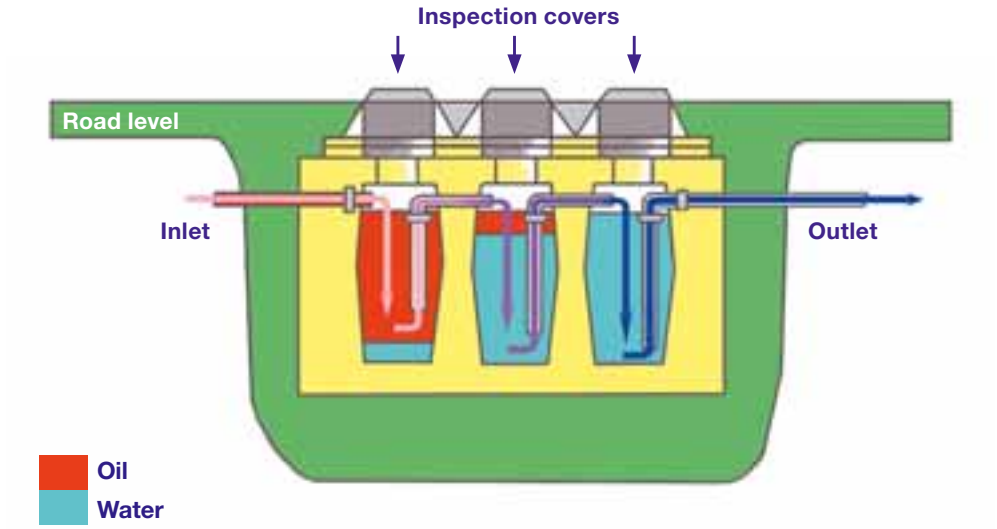
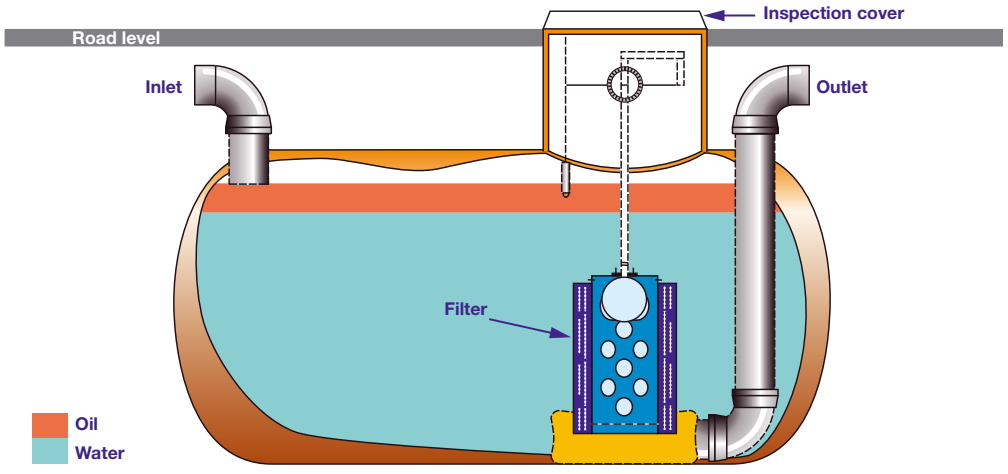


Diagram credit – The Fire Service College

The diagram above details an older style three-chamber oil separator and the flow of water and floating material (such as oil or fuel). Commonly these devices discharge to surface or groundwater.

Figure 1.28



A single-chamber oil separator showing oil or fuel floating on top of water.

A common misconception associated with oil separators is that they will collect all types of pollutants. This is not the case, as only floating materials such as oil or fuel are contained. Other material that is miscible with water will pass through the system entering the foul or surface water system. Also, a separator will not work effectively for dissolved (soluble or emulsified) oils or detergents (eg firefighting foam) or if degreasers are present, as in vehicle wash water. Such discharges should be drained to foul sewer.

Although standard size oil separators are effective at containing fuels and oils in 'daily' spillage conditions, they are unable to separate products from large quantities of water that might be found during fire run-off conditions. In these circumstances the system may be overcome by the 'shock load' allowing the pollution to pass through into surface water.

Oil separators at fuel filling stations are designed to retain the contents of one road tanker compartment; around 7,600 litres. In cases where the risk of rainfall and large spillages occurring at the same time is considered small, then a bypass separator may be employed. These units are much smaller than conventional full retention separators as they are designed to only treat rainfall up to 5 mm/hr. They are useful where there is a risk of frequent small spillages and/or where the aim is to capture the first flush of polluting material washed off when it starts to rain. When rainfall exceeds this volume or there is a very large spillage the extra flow will bypass the separator.

Waste oil contained in separators is classified as hazardous waste by hazardous waste legislation and should only be disposed of using registered waste carriers and licensed/permitted waste sites.

PPG3 applies to oil separators. This can be found at www.environment-agency.gov.uk.

1.7 Motorway and highway drainage

1.7.1 Road drainage

This section provides a description of the types of drainage to be found on roads in the UK and suggests options for containing polluting material. This information, together with local knowledge of the type, location and destination of such systems, will enhance FRS ability to protect the environment from polluting material produced at incidents on roadways. The section describes how rainfall falling on roads (the "run-off") is collected and conveyed, how and where it is discharged and what arrangements may be in place to reduce the risk of pollution. Just as there are many classes of roads, so there are many different ways in which this run-off is dealt with.

HIGHWAY AUTHORITIES

The responsibility for managing motorways and trunk roads lies with the Highways Agency in England, with Transport Scotland for similar roads in Scotland, and in Wales and Northern Ireland their respective Assemblies. Some roads are now managed by private companies. Other 'A' roads and all minor roads, bridleways and footpaths are managed by local authorities (local authority highways departments) usually the county councils or unitary authorities.

The highway authorities, both national and local, are exempt from the need to apply for discharge consents for roads draining to surface or groundwaters. They do, however, have a duty to ensure that road run-off does not cause pollution. They do this by arranging for appropriate pollution control measures to be designed, installed and operated on roads under their control.

DRAINAGE PRINCIPLES

Unlike urban roads, which are almost all kerbed and drained using gullies, rural roads (which include most motorways) can be drained using a variety of methods. The drainage method chosen for any particular location will vary according to the volume and quality of the run-off, distance from a watercourse, local geological, topographical features and availability of drainage infrastructure in the locality. There are three major objectives in the drainage of roads:

1 To remove surface water quickly to provide safe roads and minimum nuisance

2 To provide effective drainage to maximise the life of the road

3 To minimise of the impact of the run-off on the receiving environment.

TYPES OF ROAD DRAINAGE

Road drainage can be broadly classified into two elements: surface and sub-surface. These are not completely separate, as surface water will infiltrate into road foundations, earthworks or structures through any surface that is not completely impermeable, and will then be removed by the sub-surface drainage.

The drainage objectives defined above can be achieved by either of the following:

- A combined system where both surface and sub-surface water are collected in the same pipe
- Separate systems, where the sub-surface water is collected separately using a variant of a sub-surface drain, as described below.

There can be three elements in the drainage of a highway:

- Collection
- Treatment/pollution prevention (not always present or effective against all pollutants)
- Discharge.

The selection and design of systems will depend on the age and importance of the road, environmental vulnerability, pollution potential and the risk of spillage or flood. In practice, the network is likely to have a combination of systems.

INCIDENT MANAGEMENT

Because it is important that water drains quickly from the road surface, it can be difficult to intercept polluted run-off from an emergency incident before it enters a local watercourse. It is only since the early 1990s that effective pollution prevention measures have been installed in new roads. Their effectiveness will depend on a number of factors, including the type of pollutant involved and the suitability of the pollution prevention measure installed.

Where the incident has occurred as a result of a fire or RTC, FRS personnel will often be the first on the scene. If the spill is from a vehicle breakdown or minor accident, FRS personnel may not necessarily have been called. In these situations, the first responders on the scene are more likely to be from the Highways Agency or local authority. If the Highways Agency or Local Authority Traffic Officer considers they need further assistance, they may summon the FRS.

The local highway authority or Highways Agency's agents for motorways and trunk roads in England should maintain drainage plans of their local network including the location of any pollution prevention systems. These should be available to FRSs for use during the planning process or at incidents.

1.7.2 Disposal arrangements

DISCHARGE TO RECEIVING WATERS

Road run-off will be discharged either to surface waters (rivers, streams, ditches) or to groundwater.

SURFACE WATER

After passing through appropriate treatment systems, run-off may be discharged to the nearest suitable surface water. In the case of older roads, the outfall headwall will probably be the only point at which control of the run-off is achievable (apart from containing on roadways or at gullies or access covers). Locations of outfalls are available from the highway authorities.

OUTFALLS

Road drainage discharges to watercourses at outfalls (see Figure 1.29). These are located wherever the road crosses a watercourse, such as a river. Outfalls on a road can be closely or widely spaced up to a mile apart. They will usually comprise a headwall, if the road drainage is piped, or they may be ditches flowing into a river. Where it has not been possible to control a pollutant on the road, it may be possible to intercept it at the outfall by using a boom or pipe blocker or within the ditch using booms or by damming techniques (see Section 3.2.6).

GROUNDWATER

Sub-surface run-off will often discharge directly to groundwater via soakaways. These are usually large depressions that fill temporarily with water that soaks into the ground. They may also be vertical drainage pipes.

Figure 1.29

Outfalls from drainage systems may be some distance from the roadway itself. This photograph shows a surface water outfall from a viaduct (background).

Any pollution from roads in areas where discharge is to groundwater will need to be intercepted before the ultimate discharge point, as once it has reached the soakaway, it is usually difficult if not impossible to remove. Modern roads will have some form of pollution control before the soakaway, but older roads may not. It is recommended that plans of the area are studied, so that areas likely to be drained to ground can be identified, particularly those roads located above sensitive aquifers, used for drinking water and local plans formulated.

1.7.3 Run-off collection systems

SURFACE RUN-OFF COLLECTION SYSTEMS

Surface water run-off from the edges of roads in the UK is collected by a variety of systems. These are described below, together with any methods that can be used with them to prevent pollution.

Road gullies (see Figure 1.30) are a familiar and common system of collecting road drainage. They will generally discharge to associated longitudinal carrier drains, except on low embankments with ditches where it may prove more economical to discharge gullies direct to the ditches via discrete outfalls.

Figure 1.30

A typical road gully which can be blocked using a clay drain mat or inflatable drain blocker.

There are two main types of gully: trapped and untrapped. Trapped gullies contain a sump that collects silt, whereas untrapped gullies allow any debris in the road run-off to flow down the drain. Trapped gullies have to be cleaned out at least once a year. Gullies are usually connected to the main drain by a 150 mm connection pipe, which can be anything from half a metre to 15 m long depending on where the main carrier drain is located. Gullies can be sealed temporarily using the clay mats in a standard grab pack or inflatable pipe blockers. When sealing a gully, care must be taken to ensure the liquid does not flow along the road surface to the next gully (unless that too can be sealed).

SURFACE WATER CHANNELS

Surface water channels are formed as an extension to the basic pavement width of a highway, and are normally of triangular concrete section, set at the edge of the hard strip or hard shoulder and flush with the road surface. They discharge either to gullies, placed at about 100 m intervals, or occasionally to ditches, by way of drainage chutes. Gullies can be blocked using clay mats, as described above. Improvised blocking of the channel can also be achieved using polyboom or building a dam with earth and/or sand.

LINEAR DRAINS

Linear drainage channels are closed conduits into which water drains through slots or gratings. Combined channel and pipe systems comprise surface water channels having an internal pipe formed within the base of the units. Where there are gratings, it may prove possible to block these using the clay mats as described above. Where there is a slotted drain, it may be possible to use a road boom to seal this; alternatively it may only be possible to control the spill at the outfall.

GRIPS

Some minor roads are drained by ‘grips’, which comprise shallow channels excavated across verges to allow drainage from the highway to roadside ditches. It may be possible to block the grips using a boom or by constructing a soil dam.

Figure 1.31

Linear drains. Note the access cover in the foreground.

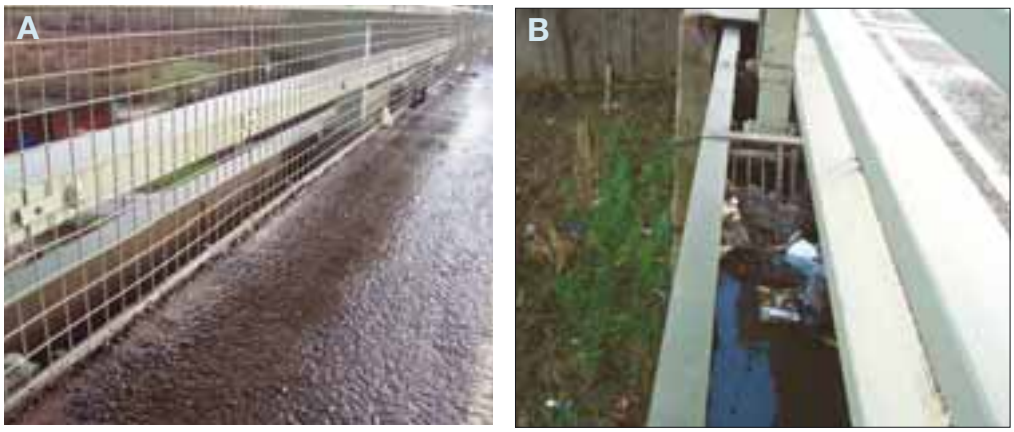
COMBINED KERB AND DRAINAGE BLOCKS

Combined kerb and drainage blocks are precast concrete units, either in one piece or comprising a top and bottom section. A continuous closed internal channel section is formed when interlocking blocks are laid. The part of a unit projecting above road level looks like a wide kerb and contains a pre-formed hole that admits water into the internal cavity (see Figure 1.32). These tend to be used where the road has a very shallow gradient, and flooding of the road is a risk. It is not easy to seal these, and if a spill occurs near this system and it cannot be contained on the roadway or absorbed with sand or other material, it will generally be best to identify an access cover or the outfall and intervene there.

Figure 1.32

Combined kerb and drainage blocks allow rapid transportation of pollutants to surface water ditches. An access cover is shown in the foreground.

Figure 1.33



A Over-the-edge drainage system allows rainwater and any pollutant to spill from the road into a water trough.

B The trough will often have a grill (shown in this photograph) to prevent larger material entering the piped drainage system. This is a point where intervention may take place if it is safe to do so. From the point beyond the grill a downpipe transports water into a ground level drain that then discharges to a nearby surface water.

COMBINED CHANNEL AND PIPE SYSTEMS

These are similar to surface water channels, with the addition of a pipe formed within the system. Where they are used in situations that require sub-surface drainage of the pavement, the sub-surface drain will be located between the pavement construction and the channel. These may be blocked using a pipe-blocker and possibly a dam of earth or sand.

OVER-THE-EDGE DRAINAGE

This method of drainage, applicable to embankment or viaduct situations, simply allows water to spill from the road edge over a continuous front. Intervention at roadside, in the trough (see Figure 1.33) or at the outfall may be suitable.

SEPARATE SYSTEM OR FRENCH DRAINS

A separate sub-surface water collection system utilises a trench or trenches filled with a high permeability material such as coarse gravel, or with a proprietary drainage system (fin drains) (see Figure 1.34); these are commonly known as French drains. In general the water environment is less likely to be affected by polluting run-off as French drains have some buffering capacity. In an emergency situation it is best to intercept at the outfall.

Figure 1.34

French drains are trenches filled with highly permeable material that discharge to a piped system or outfall. As can be seen in this photograph, grills may be incorporated where intervention may be possible. Alternatively, intervention at the outfall is advisable.

NARROW FILTER DRAINS

Narrow filter drains are intended for use as edge of pavement sub-surface drains and use a free-draining material compatible with the adjacent soil or construction layer with a pipe wrapped in geo-textile at the base of the trench.

FIN DRAINS

A fin drain comprises a corrugated plastic sheet with a layer of filter material either side. This is laid in narrow trenches and discharges to a manhole on the surface water collection system.

CARRIER DRAINS

If suitable outfalls to ditches are not available, carrier drains become necessary. Carrier pipes are unavoidable in cuttings more than a few hundred metres in length. When discharge into a longitudinal carrier pipe is necessary, access chambers are normally provided at 100 m intervals.

POROUS ASPHALT

Many roads in the UK are surfaced with porous asphalt (see Figure 1.35). This is an open-textured surface that reduces spray from vehicles and can also retain some contaminants. Run-off from roads with this surface may therefore be slightly less polluted than otherwise, but for the purpose of this manual it should be considered similar to normal run-off. Porous asphalt surfaces connect to filter drains or similar.

Figure 1.35

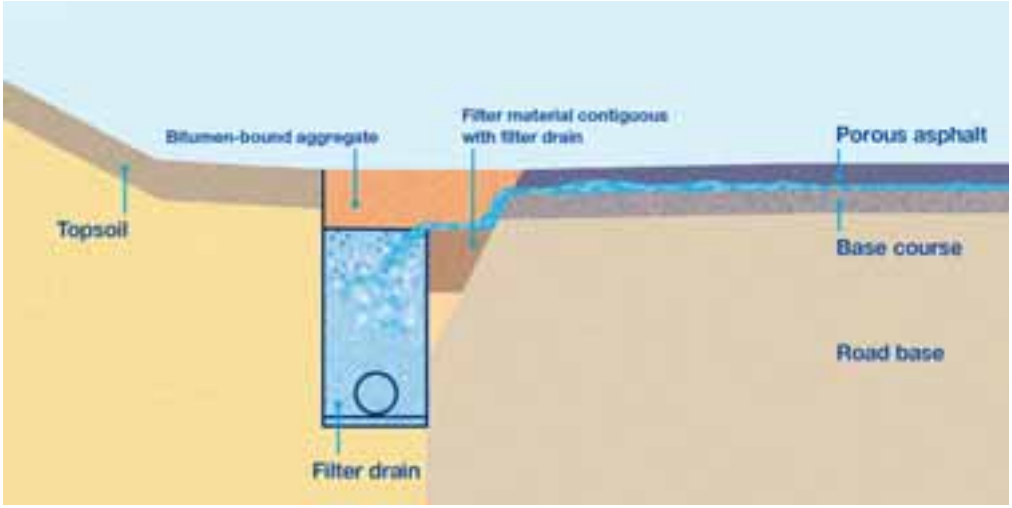


Diagram credit – The Highways Agency

Porous asphalt is a drainage system designed to reduce vehicle spray on the carriageway. Water and any polluting liquid drains through the asphalt to a base course below. Here it moves across the carriageway to a filter drain and onward to a discharge point. Where these systems are installed containment of liquids on the roadway is not a viable option and planning to contain at the outfall should be considered by local crews.

Table 1.10 Summary of drain types with means of controlling pollution

Drain type	Means of controlling pollution
Gullies	Clay mat or inflatable drain blocker.
Surface water	Clay mats, polyboom or earth channels or sand.
Linear drains	Clay mats, polyboom or control at outfall.
Combined kerb and drainage	Contain on roadway or intervene at outfall.
Combined channel and pipe system	Pipe blocker or dam in system.
Over-the-edge drainage	Dam at grate or intervene at outfall.
Sub-surface run-off collection system	Prevent entry into system.
Separate system (eg French drains, narrow filter drains, fin drains)	Prevent entry into system, intervene at outfall.
Porous asphalt	Intervene at roadside drain or outfall.

1.7.4 Treatment/pollution prevention systems

Roadside treatment and/or pollution prevention devices include oil separators, sediment traps, filter drains, wetlands and other vegetated systems. These are located between the collection and disposal elements of the drainage system and may be remote from the highway, although they are usually located within the highway boundary. It should be noted that except for balancing ponds these devices are generally only found on relatively new roads. Where they require regular maintenance or access in emergency, they will generally be signed from the highway (see Figure 1.36). They can be used by emergency responders as described below.

The types of day-to-day pollution treatment relevant to highway drainage are:

- Sedimentation – the removal of suspended solids
- Separation – the removal of all solids and non-aqueous liquids
- Containment – preventing flow from leaving the system
- Vegetated treatment processes – including filtration, settlement, adsorption, biodegradation and plant uptake (eg reed beds).

SEDIMENTATION LAGOONS AND TANKS

These structures slow the velocity of flow from the drainage collection system and retain flows for a period to allow the settlement of particulates such as grit. They are constructed above flood plain level if they are required to provide storm water control. In some cases, bypass facilities are provided so that only the first most polluting flush of run-off is given full settlement. They can be used by emergency responders to temporarily store spilt materials – a containment facility. In such cases, care should be taken to ensure the outfall, including any bypass arrangements, are sealed or blocked.

Figure 1.36

Photo credit – The Highways Agency

A typical sign indicating a pollution control device. Other signs such as 'Pollution Control Valve' may also be found.

Figure 1.37

A typical sedimentation lagoon with a headwall containing a penstock. These can be closed off by emergency responders thereby effectively utilising the lagoon as a containment facility until the pollutant can be dealt with by Highway Agencies or their contractors.

OIL SEPARATORS

Oil separators are found at various locations within the road network. Their primary function is to remove floating oil from the roadway run-off (see also Section 1.6.5).

CONTAINMENT DEVICES

Containment devices are designed to retain pollutants within the system for subsequent treatment or removal. The devices include:

- Penstocks, which comprise a flat plate, fitted to a pair of guide slots on a headwall or chamber wall. These are the most common of these devices. They are raised and lowered using a screw thread operated by a wheel. Spilled material can then relatively easily be removed by suction or other methods
- Handstops are similar to penstocks, except the plate is raised and lowered manually by a lever
- Weirs and baffles typically retain the first flush of a run-off event but allow excess flows to overtop. On occasion they are provided with a notch or orifice that can readily be blocked by a pipe blocker, sandbag or board in an emergency (Figure 1.38)
- Hanging walls comprise simple baffles constructed across open ditches, so that oils and other non-miscible pollutants are retained. The oil can be recovered from the upstream side of this device.

Liaison and training with the national and local highways agencies is necessary before these devices can be used by FRS personnel.

Figure 1.38

A typical weir baffle system that may be found adjacent to a modern road development. Using penstocks or other FRS intervention, these systems can be used to collect pollutants until they can be recovered.

VEGETATED DRAINAGE SYSTEMS

Vegetated drainage systems are used as components of a drainage network to convey, store and treat storm water running off the highway before it discharges to the receiving water. They are not designed *per se* to treat large spillages. They may either convey run-off to the disposal point or they may retain water for infiltration to groundwater or to permit settlement of pollutants. The most common systems are described below, as are their limitations.

SWALES

There is no clear distinction between swales and grassed channels, though historically the term 'swale' has been used to describe a wide, grassed channel. Water will generally flow directly from the highway into the swale along the edge of a highway. This will make it more difficult to retain a spillage on the surface of the highway, but some pollutants may be removed as run-off flows across the grassed surface. Dissolved pollutants are not usually effectively removed. If these channels discharge via gully gratings, then the gratings can be sealed temporarily using clay mats or the flow diverted to an area where it can be contained and then removed. Small spills will be absorbed into the channels, to be cleaned up later by the highway authority. Dams or fence booms might be suitable containment devices.

INFILTRATION BASINS

Infiltration basins store and treat water, and can therefore provide a containment facility for polluting materials. They are designed to retain storm water flows rather than large spillages and allow the water to percolate through a filter layer, which may typically comprise porous material, such as gravel. Run-off may then be directed to a surface water outfall, or it may continue to percolate through to groundwater. Infiltration basins have the potential to remove suspended solids and reduce metal loads, but as with swales, soluble pollutants may not be significantly reduced. They

may, however, be effective at retaining polluted run-off as described above for later removal, although they should only be used as a last resort due to difficulty with cleaning them.

WETLANDS

Wetlands can be defined as areas that are permanently saturated by surface water or groundwater so that they are able to support aquatic and/or semi-aquatic (emergent) vegetation such as reed swamps, marshes, or bogs, depending on the degree of saturation and inundation. Many pollutants will be fatal to this vegetation so discharge of polluted run-off to wetlands should be avoided if possible.

PONDS

Ponds may be designed to retain water at all times. These are sometimes known as balancing or retention ponds. By storing road run-off they can reduce flooding and allow sediments to settle out.

Ponds that are designed to be empty for some times of the year are known as detention ponds or basins. These may be suitable for the detention and temporary storage of polluted firewater run-off, or a large spillage, provided the outlet can be sealed.

COMBINED SYSTEMS

In some cases swales and ponds/wetlands are used in series. These systems may be designed so that spillages can be contained within the swale before the flow reaches the wetland. Control of the spillage can be achieved by using dams or booms in the swale.

1.7.5 Location of systems

Many highway authorities are now using GIS to digitally store details of their drainage systems. It may be possible for this information to be loaded in the form of an overlay onto FRS GIS systems at Fire Controls and/or in cabs of FRS appliances.

In areas where digital drainage data is not available the highway authority should be able to provide advice on the location and type of drainage systems present.

1.7.6 Planning

FRS personnel should be aware of the types of drainage system most commonly found on roads in their area, whether they discharge into environmentally sensitive receptors, and whether they can be used to contain spillages or firewater run-off (see also Section 3.2). Such information should be included in operational reponse plans. It is recommended that plans are produced in consultation with environment agencies and highway authorities.

1.8 Marine incidents

The Maritime and Coastguard Agency (MCA) is the competent UK authority that responds to pollution from shipping and offshore installations. The National Contingency Plan for Marine Pollution from Shipping and Offshore Installation (NCP) sets out command and control procedures for incident response. These procedures have built-in thresholds to allow for flexibility of response to different degrees of incident. The MCA monitors the movements of maritime traffic and potentially polluting substances within the UK's pollution control zone.

The MCA's Counter-Pollution and Response (CPR) branch provides a command and control structure for decision making and response following a shipping incident that causes, or threatens to cause, pollution in UK waters. MCA's CPR is based on a regional response with central operational, technical and scientific support.

Figure 1.39

Photo credit – The Maritime and Coastguard Agency

Typical incident with the potential to pollute coastal waters to which the MCA's Counter-Pollution and Response Branch would respond.

1.8.1 Response to an incident

Marine incidents are normally reported to one of the 19 Her Majesty's Coastguard (HMCG) Maritime Rescue Coordination Centres around the UK by various sources, eg a vessel in difficulty, passing vessels, or the public. HMCG will then instigate search and rescue operations where necessary; this action takes primacy over other forms of response. Where the incident involves, or may involve the need for counter-pollution or salvage control action, HMCG will alert the MCA's Duty Counter-Pollution and Salvage Officer (CPSO). The CPSO then decides the relevant course of action, instigates the appropriate level of response and alerts relevant organisations. In the event of a major incident, the MCA may activate the Marine Emergencies Information Room at their headquarters in Southampton prior to the deployment of people and equipment to the scene. Three main response centres may be set up locally:

- **A Salvage Control Unit** supporting the Secretary of State's Representative (SOSREP). Provided certain conditions are met, SOSREP is empowered to intervene as necessary in the national interest in order to mitigate or remove the threat of pollution stemming from shipping accidents. This includes the power to give directions. A similar unit – an Operations Control Unit – is set up to support SOSREP in incidents involving offshore oil and gas installations
- **A Marine Response Centre** led by the MCA to coordinate all at-sea counter-pollution and clean-up operations
- **A Shoreline Response Centre** led by the local authority with technical support from the MCA. This centre coordinates the shoreline clean-up operations. In Northern Ireland the Shoreline Response Centre is controlled by the NIEA.

Figure 1.40

Photo credit – The Maritime and Coastguard Agency

The MCA may monitor pollution events using their own aircraft or response vessels and pass information to local authority controls should the pollution threaten the shore line.

An Environment Group may also be set up in the very early stages of an incident, when a real threat to the marine and coastal environment is considered likely. This group provides environmental advice to all three specialist response centres. The Environment Group is made up of representatives of the relevant statutory nature conservation bodies, the environment agencies and Government fisheries departments.

In the UK, maritime spills are categorised by the internationally adopted three-tier system:

- **Tier 1:** a small operational spill employing local resources during any clean-up
- **Tier 2:** a medium-sized spill, requiring regional assistance and resources
- **Tier 3:** a large spill, requiring national assistance and resources. The National Contingency Plan will be activated in this case.

MCA takes the lead in pollution from shipping at sea. Various other organisations also have a responsibility to respond to pollution in the UK:

- **Ports, harbours, oil facilities and offshore installations** have a statutory responsibility for clean-up in their jurisdictions: ports to Tier 2, offshore installations to Tier 3
- **Environment agencies** take the lead in responding to pollution from land-based sources
- **Local authorities/NIEA** (in Northern Ireland) have accepted the non-statutory responsibility for shoreline clean-up.

The contingency plans of all involved organisations, whether national, regional or local, are compatible and linked where appropriate.

The MCA's CPR branch maintains extensive response equipment stockpiles, positioned at strategic locations around the UK. The main stockpiles are at Perth, Huddersfield and Milford Haven, with additional boom containers in Southampton, Inverness, Oban, Llanelli, Truro, Ely, Darlington and Belfast, and oil dispersant at 11 locations around the UK.

The CPR branch maintains satellite and aerial surveillance capability. Regular airborne surveillance flights are undertaken to monitor pollution from shipping across the UK pollution control zone and aircraft are regularly deployed following reports of incidents to assess the size and extent of any reported pollution, and to identify any contravention of national or international law. The MCA also maintains dispersant stockpiles for aerial spraying during major incidents.

International legislation governing contingency planning for hazardous and noxious substances (HNS) has also been implemented into UK law. The MCA is the responsible authority to administer this function and this has been achieved with the introduction of the National HNS Response Team (HNS-RT) for maritime incidents. This team is made up of chemical response specialists and salvage experts who provide a unit capable of rapid deployments and extended duration operations within a hazardous chemical environment. It is intended that the HNS-RT will work closely with the Maritime Incident Response Group (MIRG) FRS teams during maritime chemical incidents.

Note
MIRG comprises 15 FRS teams strategically placed around the country. They can be deployed at short notice by helicopter if necessary.

Chapter 2

Planning to protect the environment

2.1 Liaison and protocols

One key element underpinning the development of the partnerships between environment agencies and the FRS has been the signing of formal agreements. These set out the roles and responsibilities of both parties at emergency incidents and identify the working arrangement when dealing with areas of mutual interest. This section explains the structure in place for effective liaison between the FRS and environment agencies.

In Scotland the agreement has taken the form of a strategic Memorandum of Understanding (MoU) between the Scottish FRS and SEPA. In Northern Ireland it is in the form of an MoU between NIEA and the Northern Ireland FRS (NIFRS) relating to 'InterAgency Response to Pollution Incidents' involving environmental damage. In England and Wales it is in the form of a Protocol between the Local Government Association (LGA), the Welsh Local Government Association (WLGA), and the Environment Agency on FRS issues.

Although the format of the documents varies, they all have a common purpose: namely to ensure effective cooperation between the FRS and environment agencies when dealing with emergency incidents.

The key aims of the agreements are to:

- Minimise the hazard to the environment from FRS activities, including firefighting, and from incidents involving environmentally harmful substances caused by a third party, without compromising the FRS role in protecting people
- Encourage liaison between the FRS and the environment agencies, particularly at the planning stage to ensure they coordinate their response to incidents with the potential to pollute the environment
- In England and Wales, promote liaison to improve the planning and coordination of responses to flooding incidents by the Environment Agency and the FRS.

It is recognised by all parties that the implementation of these agreements will help the environment agencies and FRSs carry out their roles and duties, namely:

- The FRSs' responsibilities to extinguish fire, save life, protect communities and mitigate the impact of their activities on the environment
- The environment agencies' role in protecting and enhancing the environment
- The duty placed on both parties as Category 1 Responders by the Civil Contingencies Act 2004 and the associated Regulations and Guidance to work together in many areas; these include emergency and incident response planning, and information sharing (see Section 1.5, FRS legislation).

Formerly, many of the agreed procedures and working arrangements underpinning the partnership were included in the Protocol or MoUs. With the publication of this FRS manual it has been recognised that there is no longer a need for these documents to contain such procedures and advice in detail.

Therefore the format and content of the agreements are focused on setting out the roles, aspirations, direction and commitments to the development of the partnership of all parties.

LOCAL WORKING AGREEMENTS

The Protocol/MoUs also recognise that there needs to be scope for local flexibility for how individual FRSs and environment agency areas work together. This is to ensure local needs and circumstances are taken into account within a common National Framework. A template for producing such a Local Working Agreement can be found in Appendix 1.

2.1.1 National partnerships

To ensure that the partnerships between UK FRSs and environment agencies continue to function and improve, a National Environmental Strategy Group (FRSs and environment agencies) (NESG), a National Environmental Operational Group (FRSs and environment agencies) (NEOG) and a network of regional liaison meetings occur at regular intervals throughout each year. The aim of the initiative 'In Partnership Towards a Safer and Cleaner Environment' is the basic remit for each group.

A summary of terms of reference for each group is included as Appendix 2.

2.2 Pollution intervention planning

This section provides guidance to FRSs on how to identify sites where there is a risk to the environment. Where such risks are identified (for example, during audits of premises for fire legislation purposes or from information provided by environment agencies) it then provides further guidance on the information FRSs should consider when developing an Operational Incident Plan. These may form part of the planning arrangements under 7 (2) (d) of the Fire and Rescue Services Act 2004 (or Scottish or NI equivalent) to gather appropriate information. The section explains why such plans are needed, what information should be included and suggests a template (see Appendix 3) for those preparing a plan. FRS personnel involved in pollution

intervention planning should be aware of the recommended content of these plans and operational options available to prevent or control pollution at incidents (also see Section 3.2, Pollution control techniques and Section 3.6, Controlled burn).

This section also provides guidance on the FRS's role in assisting site operators, premises managers or other organisations or agencies in reducing the risks on their site and the development of their own pollution incident response plans. The sites or premises considered suitable for such activity include industrial, commercial and other premises, which pose a significant risk to the environment in the event of a fire, explosion or spillage (see Section 2.3.3).

2.2.1 FRS roles and responsibilities in pollution intervention planning: legislative background

Through Fire Service Circular 7/2003, the Fire and Rescue Services Act 2004 and the Fire (Scotland) Act 2005 the requirement for fire authorities to produce integrated risk management plans (IRMPs) or risk reduction plans (RRPs) has been established. Such plans are designed to improve the safety of communities and use FRS resources more productively. Further guidance on producing such plans is included in the Fire and Rescue Service National Framework Document.

One aspect of response or reduction planning is the need to consider the protection of the natural environment as well as public safety. The protection of plants and animals by FRSs, although not a duty, is an expectation, as part of the IRMP (RRP in Wales) process. These issues are discussed further within Section 1.5. The Department for Communities and Local Government has provided national guidance for FRSs in order to assist in the production of IRMP strategies including environmental elements. Guidance on environmental protection is provided in the following areas:

- Scope, including legislative, Government Public Service Agreements, National and Local Policy and Corporate Social Responsibility
- Risk analysis
- Strategy
- Delivery mechanisms
- Monitoring and review.

The Civil Contingencies Act 2004 also provides requirement for FRSs and environment agencies to plan together as Category 1 responders (also see Section 1.5).

The Civil Contingencies Secretariat issue Local Risk Assessment Guidance (LRAG) annually to support Category 1 responders in fulfilling their statutory duty under Section 2 of the Civil Contingencies Act. The classified LRAG provides generic national guidance on non-malicious hazards occurring at a local level which Category 1 responders should consider when maintaining Community Risk Registers.

The guidance identifies the hazards that Local Resilience Forums (LRFs) may wish to consider in developing their Community Risk Registers. Likelihoods, threats and vulnerabilities are assessed for a five-year period so that the risk assessment will support strategic planning for the medium term. Risks are categorised indicating the type of threat or hazard in question, including risks to the environment, for example, major pollution of controlled waters (HL4) and major land contamination (HL5).

FRSs should give consideration to the risks identified in their local Community Risk Registers when preparing an IRMP/RPP Environmental Protection Strategy. This information will also support FRSs when formulating 7 (2) (d) plans for specific premises.

2.2.2 Benefits of planning

It is essential that FRS managers give appropriate priority to environmental protection activities during the planning process. This will assist FRSs when determining appropriate operational response/tactics to minimise the impact of incidents on the environment. Benefits include:

- Minimising impacts on plants and animals which need a clean uncontaminated environment
- Protection of public drinking water supplies, thereby protecting public safety
- A pollution intervention or response plan that can be shown to have helped mitigate/prevent pollution could be used as part of the defence described in water resource protection legislation (see Section 1.4) for both site operators and the FRS.

For the reason highlighted above FRSs should allow for pollution prevention activities within their annual planning process.

2.3 Identification of ‘at-risk’ sites by operators

Although many premises types, activities and materials pose an environmental risk, the potential impact of an emergency incident is not always realised. This is because three components need to be present before a risk to the environment exists: a source, a pathway and a receptor.

If any parts of the source–pathway–receptor link are missing then the environmental risk is removed.

Examples of sources, pathways and receptors are shown in Table 2.1 and illustrated in Figure 2.1.

Environment agencies recommend that all operators undertake an assessment of the nature and level of environmental risk that their site poses. At sites regulated by them, this will be a requirement of their permit.

Table 2.1 Sources, pathways and receptors

Pollution source	Pathways	Receptors
Hazmats	Dry ditch	Humans, plants, animals or birds either directly (eg drinking or contact with contaminated water, inhaling smoke) or indirectly (eg through the food chain or reductions in dissolved oxygen levels)
Eco-toxic, organic or inorganic, low-hazard materials, or combustion products	Stream	
	River	
	Lake	
	Permeable ground	
	Surface water drainage system	
	Foul sewer system	
	Air	
	Roadways	
	Land drains	

Figure 2.1

Photo credit – The Environment Agency

These three photographs show the source – water containing silt, the pathway – the drainage system and the receptor – a local stream.

The first stage in the risk assessment process should be a simple risk screening assessment followed by a more detailed environmental risk assessment if necessary. The results of this assessment should be discussed with the FRS and environment agencies ideally at joint meetings.

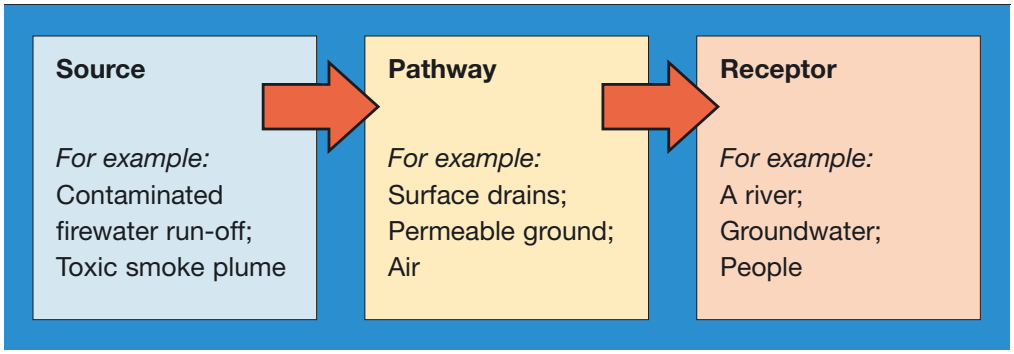
2.3.1 Carrying out the assessment

Although the responsibility of site operators, FRS personnel need to be aware of the process that operators must follow when carrying out an environmental risk assessment. This is because the results of such an assessment are likely to influence the FRS Operational Incident Plan.

It is also recommended that at high-risk sites which have an existing 7 (2) (d) Operational Incident Plan there should be an assessment of the environmental risk (environment agencies will help carry out initial screening of sites with such plans). Where a significant risk to the environment is identified, pollution prevention information should be included within the plan. This approach is supported by NESG.

A 7 (2) (d) model plan can be found as Appendix 4. FRSs may also decide to produce their own Operational Incident Plans of generic site types that might pose a particular risk to the environment, eg agrochemical stores (see Section 2.5), timber treatment plants, plastic manufacturing and recycling sites, etc.

Figure 2.2



Examples of sources, pathways and receptors. For pollution to occur all three parts of the model must be in place.

The starting point for any such environmental risk management evaluation is the identification of possible hazards to the environment (the source) and, where identified, the adoption of appropriate preventative measures to reduce the risk of pollutants being transported (via a pathway) from the immediate area to the vulnerable aspect of the environment (the receptor) (see Figure 2.2).

Details of techniques for undertaking environmental risk assessments can be found in PPG 28, Controlled burn (www.environment-agency.gov.uk).

2.3.2 Possible response strategies

Where an environmental risk assessment indicates a high or medium risk of pollution in the event of a fire or spillage, site operators in liaison with the FRS and environment agencies need to consider ways of reducing the risk to an acceptable level. The link between fire prevention or suppression and pollution prevention or reduction is a key factor for FRS personnel advising operators or environment agency officers.

There is a hierarchy of four principal ways to reduce the risk. One or more of these may be employed at any given site. These are:

1 PREVENTION

Preventing the outbreak of fire, for example, by controlling sources of ignition or segregating incompatible substances, will reduce the likelihood of an emergency incident that threatens the environment.

2 DETECTION

The risk of a significant impact to an environmental receptor during or following an emergency incident can be minimised by the installation of appropriate fire and spillage prevention and detection systems. These include smoke, heat or flame detectors and water or foam sprinklers (see Figure 2.3) or other fixed installations. The provision and training of firefighting teams may also be considered. Environment agencies and other regulators may require such systems within a permit condition of a site they regulate. See Section 1.3.4.

3 CONTAINMENT

Although planning and preventative measures (see Chapter 4) will reduce the likelihood of such an emergency incident occurring, it will not eliminate completely the risk of pollution from firefighting or a spillage. Environment agencies therefore promote the installation of firewater and spillage containment systems.

There are a variety of options available such as bunds (see Figure 2.4), containment lagoons, tank shut-off valves/penstocks, oil separators and emergency containment systems such as a bunded car park. By installing such features a predicted volume of firewater run-off or spillage can be effectively stored until arrangements for removal and disposal can be made. Further detailed guidance is found in PPG 18, Managing Firewater and Major Spillages (www.environmentagency.gov.uk).

Note
When sprinkler systems are installed, it may be possible to reduce the storage volume of any bunds, firewater ponds, etc. This should be considered on a site-by-site basis involving discussions between the operator, FRS and the appropriate environment agency.

Figure 2.3

An example of foam sprinklers installed in racking at a warehouse storing highly flammable materials. Such suppression systems can act to prevent or reduce the environmental impact of a fire.

Figure 2.4

The yellow line in the foreground of this photograph is the top of a bund that serves the chemical handling area in the background of this photograph. The draining system transports the spillage to a 'blind tank' (tank without an outlet) where it can be removed by suction tanker.

4 MITIGATION

Planning for the use of suitable firefighting and/or spill containment strategies, such as:

- Reducing the amount of firewater generated; for example, by the use of sprays or foam branches rather than jets
- Recycling of firewater run-off where this is not hazardous
- A controlled burn strategy when appropriate to do so, whilst protecting adjacent risks (eg nearby storage tanks) with water sprays or curtains. The potential for contamination of this water should also be considered (see Section 3.6, Controlled burn).

2.3.3 Determining which strategy to adopt

The decision to adopt a particular strategy or combination of strategies should ideally be made at planning stage, but might be during the dynamic risk assessment process at an incident. During planning activities, the risk assessment process should consider:

- The scale and nature of the environmental hazards presented by the site and the activities that take place on it
- Whether the products/building involved in fire are likely to be lost to it
- The risks (likelihood and severity) posed to people and the environment by adopting or discounting a controlled burn strategy
- The local topography and different meteorological conditions and scenarios that could be reasonably expected at the site
- The difficulties in deciding and justifying the adequacy of the risk management measures adopted
- The local environmental vulnerabilities.

As part of the planning process it is envisaged that a joint meeting between the site operator, local FRS and environment agency officer will take place to consider the best environmental option. Hazmat or HMEPOs will on most occasions be the most suitably qualified FRS officers to attend such meetings.

When agreement has been reached, the FRS Operational Incident Plan for the site should be produced. This should fit in with the Operator's Incident Response Plan (see Section 2.3.5).

Premises where highly hazardous processes take place, and/or large volumes of hazardous materials are stored that are regulated under the Control of Major Accident Hazard (COMAH) Regulations 1999, and premises that are licensed nuclear sites are not specifically considered in this section, although many aspects discussed will be useful to FRS and environment agency personnel dealing with such sites.

2.3.4 Site operators

Pollution legislation (see Section 1.4) requires that site operators protect the environment from the effects or impacts of polluting incidents. The production of a pollution incident response plan by operators can help them achieve this aim by ensuring that impacts on the environment are minimised should an incident take place. For some sites such as those falling under the Environmental Permitting or PPC Regulations the production of such a plan will be a specific requirement of their permit.

2.3.5 Development of site-specific Incident Response Plans

When a risk site has been identified, operators should be encouraged to produce an emergency pack or wallet for the site. It is recommended that this is produced in consultation with the FRS and environment agencies. At licensed or permitted sites this may be a requirement of the regulator.

The emergency pack should include:

1 A contact list

2 A site drainage plan

3 Site chemical, product and waste inventory

4 Emergency procedures.

1 CONTACT LIST SHOULD CONTAIN TELEPHONE NUMBERS FOR:

- Emergency services
- Relevant environmental regulators
- Local water supplier and sewerage undertaker
- Health and Safety Executive
- Appropriate clean-up contractors
- Key holders
- Staff to be contacted in the event of a significant incident
- Specialist advice such as chemical suppliers whose products are held on site.

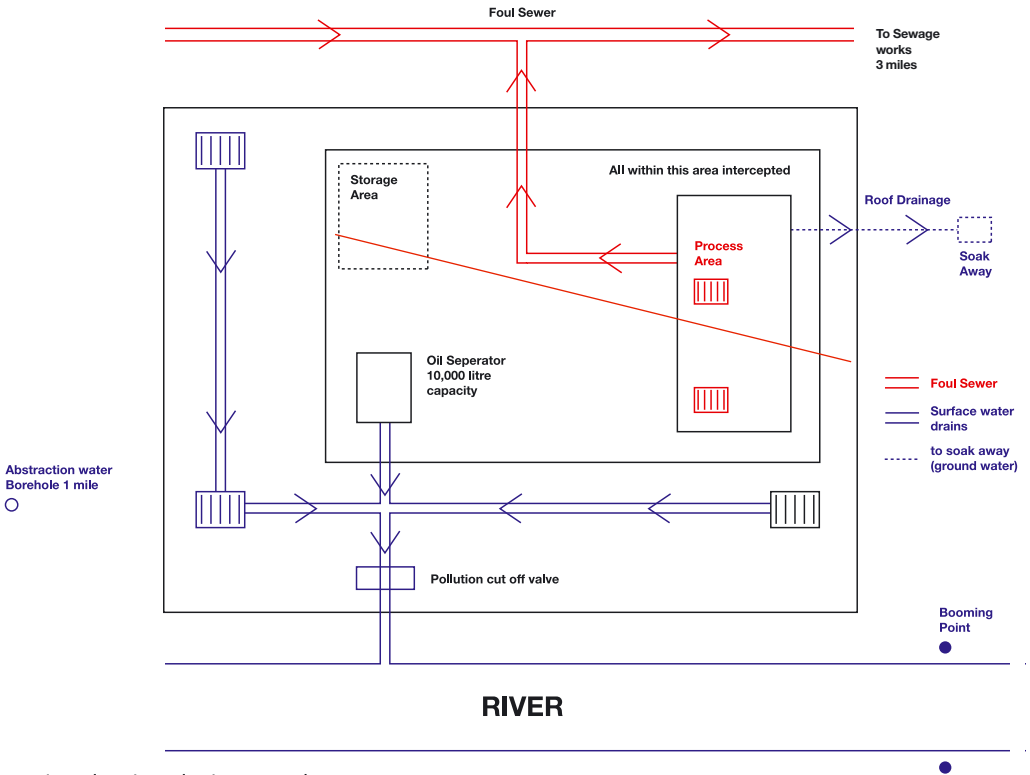
2 A SITE LAYOUT AND DRAINAGE PLAN

Occupiers should provide a clear diagram of the site showing layout and access details with a schematic representation of the site drainage arrangements. The site plan would ideally be kept in an emergency box and contain (see Figure 2.6):

- The general layout of buildings
- Site access routes for emergency vehicles
- Location of process areas and any on-site facilities for trade effluent or domestic sewage

- Areas or facilities used for the storage of raw materials, finished products and waste (including tank sizes)
- Any bunded areas together with details of products stored and estimated bund retention capability
- Any potentially sensitive and/or vulnerable areas of porous or unmade ground on site or in the immediate vicinity
- Location, depth and construction details of any soakaways receiving surface water discharges
- Location of mains water supply stopcock and any sprinkler control valves
- Location of hydrants, 'fire boxes' and pollution prevention equipment, eg spill kits, booms, etc
- Facilities such as:
  - Inspection points for the detection of pollution
  - Oil separators (includes capacity and type)
  - Spillage retention or balancing tanks
  - Firewater retention ponds
  - Containment tanks and pollution control devices
  - Suitable locations for siting portable storage tanks or for creating reservoirs by blocking drains etc

Figure 2.5



A simple site drainage plan

Brief descriptions of how each facility operates and clear marking above ground are essential. In some cases, additional plans will be required to provide detailed information. These should be attached to the main plan and referenced in it.

A site drainage plan (see Figure 2.5) should be produced using **red** to mark foul drainage and **blue** for surface water with an indication of direction of flow.

A similar marking system for drain covers should be used. These can be numbered to assist identification during an incident (also see Section 1.6.1).

The plan should also include, where appropriate:

- Off-site discharge points for surface water and trade effluents and the location of any soakaways
- Identify the sewage treatment works and the nearest foul sewer pumping station serving the site (this information will be available from the local sewerage undertaker)
- Show any watercourse, spring, borehole or well, located within or near to the site
- Indicate the estimated time of travel and direction of flow to any surface water and/or any vulnerability of boreholes and wells
- Show suitable points for installing pollution control booms, pipe blockers and/or dams.

Note
If possible, permanent boom anchor points at a suitable location, taking into account possible watercourse flow conditions, should be installed. These may be installed as a condition of the permit or licence for the site issued by environment agencies or other regulators.

3 SITE CHEMICAL, PRODUCT AND WASTE INVENTORY

Occupiers of sites that pose a significant risk to the environment because of the eco-toxic nature of their inventory should be advised to provide an inventory to be kept in the 'emergency pack'. The product and/or waste inventory should provide up-to-date records of all substances on site together with an indication of the maximum quantities likely to be stored or found in production facilities or pipelines. Product data sheets and Control of Substances Hazardous to Health Regulations 2002 risk assessments should be attached for any substance posing a risk to health and/or the environment. The possibility of products mixing and their combined effect on the environment must also be considered by occupiers.

4 EMERGENCY PROCEDURES

Detailed emergency procedures produced by the occupier in consultation with the FRS and environment agency and should define:

- The scope of the activities covered
- Staff responsibilities
- Procedures for dealing with events such as spillages, leaking containers and fire water run-off.

These are often required by regulators of installations.

The level of on-site response will depend on the hazards and risks associated with the spilled materials, the levels of staff training and numbers of people, personal protective equipment (PPE) and pollution control equipment available. Additionally, strict guidelines for when to call the FRS must form an integral part of the emergency procedure.

The following can be used as a checklist for occupiers and FRS personnel when formulating emergency procedures:

- Alerting the FRS immediately using the 999 system as well as environment agencies, sewerage undertakers, local authorities and other stakeholders in the event of an incident
- The most suitable firefighting strategy: is an intervention or controlled burn strategy appropriate based on environmental and other risk factors, eg risk to firefighters? (see Section 3.6)
- A systematic approach to alerting abstractors and other river users that could be affected by the incident. This would normally be a role undertaken or coordinated by environment agencies. This should be recognised in the plan
- Procedures for alerting site and adjacent site staff. This should include evacuation procedures
- The selection of appropriate PPE
- Means of making leaking containers safe
- Procedure for containing spills and fire run-off water including equipment and material provision. The availability of FRS pollution equipment may also be agreed at this stage
- Procedures for the recovery of spilled product or fire run-off water including the appropriate hazardous waste arrangements.

Emergency plans should be reviewed at suitable intervals and exercised during training events involving all stakeholders. This will contribute to ensuring that incidents, when they occur, have little or no impact on the environment.

Further guidance on pollution incident response planning can be found within PPG 21 Pollution Incident Response Planning (www.environment-agency.gov.uk).

Note
There are over 16,000 sites with an environmental permit or licence in the UK where it may be possible for FRSs to advise environment agencies on suitable measures to prevent or reduce pollution. Such advice might include automatic fire detection (AFD), fire sprinklers, maximum storage quantities, provision of fire breaks and likely containment requirements for firefighting water. These may be addressed within the permit or licence condition.

It is recommended that discussions take place locally during the permitting/ licensing process to ensure that such advice is considered when determining the permit or licence conditions for the site.

Figure 2.6

Photo credit – Gerda Technology Ltd

Emergency boxes either inside premises or adjacent to perimeter access points are designed to contain emergency response information including that necessary to protect the environment. Such emergency packs may be a requirement of the licence or permit to operate the site, issued by regulators.

Availability of emergency pack

When an emergency pack or wallet has been produced, operators should be advised to store it in a secure location or 'fire box' away from the main areas of risk, near to the site entrance and clearly marked. Operators should be also instructed that they must have procedures in place to ensure that the emergency pack is handed to or immediately available to the FRS on their arrival at an incident. Where a 7 (2) (d) Operational Incident Plan exists for a site that is provided with an emergency pack, the location of the pack should be clearly identified within this plan.

Vehicle-mounted data systems

Many FRSs utilise vehicle-mounted data systems (VMDS) for the storage of information on fire appliances. Such information may include Operational Incident Plans. Once the information relating to pollution intervention planning has been obtained and collated, it should be loaded onto the VMDS. This information will enable effective planning for environmental damaging incidents and support timely and informed operational decisions aimed at instigating effective pollution prevention measures.

Figure 2.7

Photo credit – Lancashire Fire & Rescue Service

A typical vehicle-mounted data system (VMDS) that may be capable of storing critical environmental protection information.

2.4 Local environmental protection planning

To empower FRS crews to deal effectively with incidents that have the potential to pollute the environment, it is essential that they have sufficient knowledge of, and access to, appropriate information regarding:

- Potential pollution sources
- The sensitivity and vulnerability of the environment in their local area
- The pathways that any pollutant will follow before it enters the environment.

FRS personnel should endeavour to research this information for their local area. It is recommended that contact is made with the appointed FRS environment agency liaison officer and other parties such as highway agencies and sewerage undertakers. These contacts will be able to provide details of environmentally sensitive areas, eg those where an incident could threaten a water abstraction point and/or important nature conservation site as well as information such as drainage systems, sewage treatment works and their outfalls, etc, in most cases in GIS overlay format.

Once the information has been obtained and collated it is recommended that maps or plans of station areas indicating these features are produced and displayed at fire stations. These will allow managers and firefighters to develop operational incident tactics that include environmental aspects. It is recommended that such plans are:

1 Displayed within training or other appropriate areas of fire stations

2 Carried on front-line appliances, environmental protection units and command units, ideally in GIS format

3 Installed in Fire Control rooms

4 Coordinated and supported by HMEPOs or equivalent.

Specific information that should be obtained includes the following:

2.4.1 Local watercourse plans

Knowledge and information about the location, flow, direction and destination of streams, rivers and outfalls from lakes, lochs or reservoirs, together with suitable intervention points.

2.4.2 Water abstraction points

Knowledge of the areas where an incident could threaten public surface water abstraction points, wells, boreholes and springs will be beneficial to attending crews. Such locations can be provided by local water companies (who provide drinking water), environment agencies and environmental health departments of local authorities, and may be available as GIS overlays.

2.4.3 Local drainage plans

Equally important is the identification of surface and foul water drains, including the direction of flow. Maps of the public sewer system are available from sewerage undertakers and some environment agencies. Private drainage system plans, eg those for an industrial estate, may be available from environment agencies or from the estate owner or site operators.

2.4.4 Vulnerable habitats

The location of any important nature conservation sites such as Sites of Special Scientific Interest (SSSIs) or similar can be identified and included within fire station plans. These are available from the appropriate conservation body.

2.4.5 Groundwater

Maps of sensitive groundwater and aquifers can be obtained from environment agencies.

2.4.6 Vulnerability of the water environment

There are a number of factors influencing the impact that a pollution event has on the environment. These include the toxicity of the polluting substances involved, the pathway by which the pollution finds its way into the environment and the sensitivity of the receiving environment or receptor.

This sensitivity will be determined by the uses that any particular waterbody is put to and physical factors such as temperature, the dilution afforded and the chemical composition of the receiving waters themselves (also see Section 1.2.3).

As an example, a spillage of the same quantity of a hazardous material into a small trout stream directly upstream of a public drinking water intake is likely to have a greater impact than if the discharge was made into the estuary of a large river. Similarly the impact of a spillage of an organic pollutant such as milk at the same location in a river is likely to be more serious in summer due to lower flows and higher water temperatures.

An understanding of the sensitivity of local watercourse and groundwater is useful for FRS planning officers and crews. For areas that drain to environmentally sensitive locations, a high priority should be given, during the planning process and at incidents, to the containment of spillages and polluting fire water run-off. In less sensitive areas whilst containment is still desirable it is recognised that there may be other priorities which take precedence over environment protection work. FRS personnel should consult with their local environment agency office to obtain this information.

Examples of the features that can be considered when determining the sensitivity of the site are listed in Table 2.2.

Table 2.2 Sensitivity of receiving waters in relation to location

Sensitivity	Location
High	Over a major aquifer
High	Within a designated Groundwater Source Protection Zone
High	Within 250 m of any well, spring or borehole used for drinking wate abstraction other than within a Groundwater Source Zone
High	Above a shallow water table (< 2 m and with free-draining ground)
High	Above a fissured rock, eg chalk, posing risk of rapid flow to groundwater or surface water
High	Less than 5 km upstream of a surface water drinking water abstraction point
High	Less than 5 km upstream of an important surface water industrial or agricultural abstraction point
High	Firewater/spillage would impact on a commercial fishery and/or a national or internationally important conservation site
High	Firewater/spillage would impact on a site of high amenity value

Table 2.2 *continued*

Medium	Situated over a minor aquifer
Medium	Between 5 km and 20 km upstream of a surface water drinking water abstraction point
Medium	Between 5 km and 20 km upstream of an important surface water industrial or agricultural abstraction point
Medium	Firewater/spillage would impact on a coarse fishery or locally important conservation site
Medium	Firewater/spillage would impact on a site of moderate amenity value
Low	Situated over a non-aquifer
Low	Outside any designated Groundwater Source Protection Zones
Low	Situated above deep water tables
Low	Situated on low permeability ground such as clay
Low	More than 20 km upstream of a surface water drinking water abstraction point
Low	More than 20 km upstream of an important surface water industrial or agricultural abstraction point
Low	Firewater/spillage would have limited impact on fish populations or wildlife
Low	Firewater/spillage would impact on a site of limited amenity value

2.5 High-pressure oil pipelines

Note
High-pressure gas pipelines are not a topic of this manual. Other liquid pipelines transporting, for instance, brine can be found at various locations within the UK. Similar response planning activities to those detailed within this section may be suitable for these risks.

2.5.1 Background

A network of high-pressure oil pipelines used for the underground transportation of flammable liquids (products) has been constructed through most regions of the UK. A high-pressure oil pipeline can extend for hundreds of miles and have branch lines feeding from it, controlled by remotely operated valves. Liquid pipelines are constructed of between 100 mm and 410 mm diameter high-grade welded steel pipes (typical wall thickness of 8–10 mm). Except at refineries, storage facilities, above-ground river crossings or pumping stations, the pipelines are laid into approximately 1.5 m deep excavations (see Figure 2.8). Pipeline operating pressures vary from 40 to 100 bars and function day and night.

Pipeline operation is based on highly advanced computer and mechanical technology. Software-based monitoring and sensoring, supported by remotely operated mechanical valving systems, have ensured that the UK has not experienced a major oil pipeline disaster to date (see Figure 2.9).

Figure 2.8

Oil pipelines can operate at between 40 and 100 bar, are constructed from 8-10 mm steel and are laid as shown here in a 1.5 metre deep trench.

Figure 2.9

A typical high-pressure oil pipeline control centre that oversees the remote operation of pipeline control valves.

Examples of products that may be transported by high-pressure oil pipeline in the UK are:

- Petrol
- Diesel fuel
- Dyed diesel fuel (red diesel)
- Aviation fuel
- Crude oil of varying viscosity
- Ethylene.

Oil pipelines can be, but are not exclusively, used to transport single products. At any one time several products may be in a pipeline destined for a different location in the UK. This is achieved by pumping or 'backing up' products into the pipeline immediately following one another. Only limited mixing of products occurs because of flow characteristics and pressures used. Mixed products are drawn off and recovered for reprocessing. Consequently, should a leak or breach occur, it is possible for two or even three different products to be released into the environment.

The quantity of product that may be expelled from a breached pressurised liquid pipeline will depend on a number of factors. These include the size of the breach, the type of product involved, the pressure and size of the pipeline and the topographical location of the breach. Dependent on these circumstances, it can be estimated that should a break occur, between 30,000 and 2 million litres of product could be ejected over a 30-minute period, causing a significant public safety and/or environmental disaster.

Note
A large road petrol tanker has a 40,000-litre capacity.

A number of commercial companies and the UK Government operate the network of high-pressure oil pipelines in the UK. Each pipeline operator controls product distribution via control centres (see Figure 2.9) that can remotely open and shut valves to direct a product to its destination. Additionally, manual valve operation is possible at intermediate valving locations (see Figure 2.10). Both types of valve can be utilised during a breach situation.

Figure 2.10

A typical remote valving location. FRS crews may be asked to operate such valves in an emergency and should have local knowledge of their location.

2.5.2 Planning

IDENTIFICATION OF PIPELINES WITHIN EACH FRS AREA

The majority of high-pressure oil pipeline operators in England and Wales subscribe to the Linesearch website (www.linesearch.org) which allows contractors planning excavations to immediately identify the proximity of subterranean oil and gas pipelines. In Scotland no such system exists and direct contact with oil refinery companies will be necessary. Oil pipelines that operate in Northern Ireland run from Cloghan Jetty on the North side of Belfast Lough to Larne Power Station and from a river berth to Londonderry Power Station.

An additional website, Linewatch (www.linewatch.co.uk) can be utilised by FRSs for planning purposes. This facility allows searches to identify the general location and dimensions of oil pipelines. Then using telephone numbers provided on the website, specific companies can be contacted and may provide GIS maps of routes and valve locations etc. It should be noted, however, that not all pipeline operators currently subscribe to this service.

Information such as the likely product type(s), pipe diameters, pipe depth, and manual valve locations, as well as the associated GIS maps, should be transposed onto FRS control room systems and local emergency response plans. Contingency arrangements including public safety and evacuation issues, firefighting foam, pollution control strategies and equipment for dealing with the likely consequences of a high-pressure oil pipeline breach should be considered at planning stage. Local FRS personnel should be familiar with oil pipeline risks including the location of pipeline marker posts and the size, product(s) type, etc of the pipeline(s) within their

station areas and receive training for dealing with breaches. Training should include lectures, site visits and practical exercises involving all stakeholders identified as a result of local analysis of the risk.

PIPELINE MARKING

Two methods of visually marking the position of underground high-pressure oil pipelines are used in the UK. These are marker posts and aerial markers.

Marker posts (see Figure 2.11) are positioned where pipelines cross roadways, railways, rivers and land ownership boundaries. They will also be found at most hedge and fence lines. These provide information regarding the pipe diameter, product characteristic (high- or low-flash; multi-product pipelines are usually shown as low-flash) the location and the pipeline owner.

Aerial markers (see Figure 2.12) are primarily for the use of oil pipeline operators who commission helicopters to over-fly pipelines to check for the visual signs of small leaks, such as discoloured vegetation, etc and unscheduled activity, eg excavations. A series of aerial marker posts provides a visual guide for the helicopter crew along the route of the pipeline. Aerial markers are also useful geographical markers for local FRS personnel when identifying the location of pipelines routes.

Figure 2.11

Oil pipeline marker post.

Figure 2.12

Aerial marker post.

INCIDENT NOTIFICATION

A number of situations have the potential to compromise the integrity of high-pressure pipelines. These include:

- Unauthorised excavations (third-party damage, see Figure 2.13)
- Landslips
- Lightning strikes
- Flooding incidents
- Mechanical failure or corrosion of the pipeline
- Operational errors
- Terrorism
- Theft.

Pipeline operators in the UK average 70 incidents each year where contractors' activities threaten to breach high-pressure oil pipelines.

Where FRSs receive calls to incidents where it is confirmed or suspected that oil pipelines are involved, the oil pipeline operators' control centre should be contacted as soon as possible using pre-arranged direct dial numbers. This will allow early valving down of the affected pipeline section, reducing the quantities of product released. The remote sensing systems used by pipeline operators will detect serious breaches allowing early isolation of the affected pipeline section. However, identification of the exact location of the breach by pipeline operators is sometimes difficult. Where pipeline operators remotely detect breaches they will contact FRS control rooms whose areas might be affected. Emergency contact details for each FRS area are held by the pipeline control rooms and form part of their emergency

Figure 2.13

This photograph shows road markings by a utility company who planned to excavate a roadway in line with a high pressure oil pipeline. Note the writing on the roadway and the aerial marker post in the hedge opposite.

procedures, which are tested regularly. FRSs should record these tests for future reference should an incident occur. Planning for oil pipeline incidents should be included within each FRS major incident planning regime.

Identification of the pipeline operator and the location of the control room is essential, especially where more than one pipeline flows through an FRS area.

EMERGENCY RESPONSE TO INCIDENTS INVOLVING HIGH-PRESSURE OIL PIPELINES

FRSs should consider an appropriate predetermined attendance to suspected or confirmed incidents involving oil pipelines. Where damage to pipelines has been sustained but no breach has occurred, FRSs may be asked to stand by during emergency draining-down procedures, prior to essential repair.

Dealing with an incident involving a breached high-pressure oil pipeline will vary depending on a number of factors, including topography, population, sensitivity of the local environment, ignited or unignited product, proximity of resources, availability of foam and pollution control equipment, etc. Although this section provides some advice on tactics or command practices specifically relating to oil pipeline incidents, the weight of response and tactics employed will depend on the location of the incident and local resources available.

Specifically for oil pipeline incidents, it is advantageous and best practice for HMEPOs to attend oil pipeline control rooms to provide liaison and advice to Incident Commanders and HMEPOs at incidents. Because pipeline control rooms will often not be located in close proximity to any breach, FRSs will need to make prior arrangements with pipeline operators and the FRS whose area covers oil pipeline control rooms to facilitate such support.

The following information specifically relates to oil pipeline incidents:

- Oil pipelines are mainly routed through open countryside but also flow through residential, commercial and industrial areas, passing under or over motorways, major roads, rivers railway lines, factories, etc
- The initial breach may produce a jet of product up to 10 storeys in height
- The jet, although diminishing in height, will be of significant force for up to 30 minutes after the initial breach
- Oil pipeline operators will mobilise clean-up contractors who may take up to two hours or more to arrive at the scene, dependent on traffic and location of the incident
- FRSs may receive requests from pipeline operators to operate manual valves at intermediate intervention points (see Figure 2.10)
- Pipeline operators will mobilise 'field engineers' to incidents to provide advice to Incident Commanders.

2.5.3 Guidance on actions at oil pipeline incidents

Because of the significant quantities of highly flammable product likely to be released following a pipeline breach, any incident is likely to be declared a major incident by Incident Commanders. The following is a list of issues that Incident Commanders might wish to consider:

- Evacuation of members of the public
- Providing adequate resources directed to suitable rendezvous points including sufficient EPUs
- Intervention tactics considering firefighter safety
- Initiating the delivery of large quantities of firefighting foam
- Blanketing product with firefighting foam to reduce vapour, thereby reducing the risk of ignition
- Providing resources to protect important wildlife habitats and sewer systems in local area and 'downstream' from the incident
- Tactics designed to divert product to 'sacrificial' areas such as lakes, or other low-lying areas such as roadways, in consultation wherever possible with the appropriate environment agency office, highways authority, or landowner, etc

- Ensuring water companies/other abstractors are aware of threats to drinking water and other abstractions, which can be achieved via environment agency emergency response telephone lines
- FRSs planning to deal with oil pipeline breaches should aim to work effectively with oil pipeline operators and other stakeholders who might be involved in such incidents.

2.6 BASIS (Registration) Limited store inspection scheme

BASIS (Registration) Ltd is an independent registration, standards, certification and training organisation (serving pesticide, horticulture, forestry and other relevant interests), working with and through industry organisations to implement relevant sections of the Food and Environment Protection Act 1985 and other legislative and industry Code of Practice requirements. The BASIS system is designed to be self-regulating by the agrochemical industry for the safe storage and transport of pesticides.

Part III of the Food and Environmental Protection Act 1985 has provided powers to introduce strict controls over the storage of pesticides. Additionally, the Control of Pesticides Regulations 1986 (as amended 1987) provides that storage of pesticides is subject to **all reasonable precautions** being taken to protect people, creatures, plants and the environment.

Even when diluted, some pesticides are toxic to fish and other aquatic life. In extreme cases, one teaspoonful could be enough to kill all the wildlife in a watercourse. Small quantities of pesticides can be detected in water and the limits set for water abstraction for public drinking water are exceptionally low. As little as a tea-cup full of concentrate could be enough to cause the daily supply to a city the size of London to exceed the permitted limits (see Figure 2.14).

Figure 2.14

A spillage of pesticides on a farm. The quantities involved are sufficient to have a significant impact on local drinking water supplies and wildlife.

Photo credit – Environment Agency

The Chief Fire Officers' Association (CFOA) and BASIS have established and agreed joint working arrangements which promote opportunities for FRSs to acquire operational risks information, including the risk to the environment, and to ensure fire safety resources are targeted towards higher-risk-to-life premises. The guidance is designed to assist FRS inspecting officers responsible for inspecting BASIS-registered premises. Some FRSs have indicated that they will not be undertaking inspections any longer but periodically auditing the self-assessment risk assessments produced by the site. However, it is recommended that consideration of environmental risk is undertaken as part of the IRMP process and 7 (2) (d) inspections.

Agrochemicals are used as an essential part of efficient modern farming. Their use is partly seasonal with much larger stocks being encountered in farm stores in the spring and autumn. Also the manufacturers of agrochemicals often store them on premises, remote from manufacture.

Subsequent distribution of agrochemicals is normally through a network of distributors and intermediate distributors who are expected to be registered with BASIS (Registration) Limited. The locations of such premises and distributors are notified to FRSs. Operators are required to comply with the safety provisions of the scheme, not only in respect of the storage of these chemicals, but also when in transit.

2.6.1 Protocol procedure

BASIS regularly audits its members' premises to ensure compliance with industry requirements. Part of this audit will involve the BASIS Assessor reviewing the fire risk assessment. A risk assessment model is supplied by BASIS to all its members; members are, however, free to use another model if they wish.

If the BASIS Assessor determines that the risk from the storage/process is low or medium, the relevant FRS will be advised of the existence of the store in order that they may update any hazard information systems held. No fire safety inspection will be required by the FRS, although the need for a 7 (2) (d) and 9(3)d (FRS Act 2004) visit may be determined locally.

If the BASIS Assessor has assessed the premises as high-risk, the relevant FRS will be advised of the assessment findings and a visit by a FRS inspecting officer requested. The high-risk criteria will be allocated by the BASIS Assessor according to the quantities and type of storage. Each high-risk premises will be inspected by BASIS annually and a report requested from the FRS once every five years (as long as it remains in the high-risk category).

For operational information purposes, BASIS will notify the FRS of the risk category (A, B, C; A being the highest) allocated by the environment agencies to each site. An environment agency contact will also be provided should further information be required by the FRS.

2.6.2 Administrative arrangements

In order to enable the bulk of correspondence to be handled electronically, all FRSs should update BASIS with the appropriate email contact details of the department handling these notifications and inspections. In order to avoid updating problems this should not be an individual email address.

The process will be initiated by BASIS, who will contact the relevant FRS using a standard letter. Once an email contact has been established notifications will be emailed. Where a premises has been inspected recently, the local fire safety manager will determine whether a specific site visit or a remote audit of the fire safety file is most appropriate.

Following a FRS inspection/audit of a BASIS-registered premises, the FRS should inform BASIS of the outcome of the inspection. FRSs should endeavour to respond to BASIS within four weeks of receipt of a notification.

2.6.3 Inspection/audit

BASIS-registered premises should be audited/inspected using the same inspection criteria as any other premises, ie the inspector makes an assessment of the general fire precautions and determines whether these are adequate for the hazard. It is not the remit of the FRS officer to assess the appropriateness of the storage facilities or process; this will have been assessed and approved by BASIS. **Approval of a premises by BASIS does not preclude the taking of any enforcement action the FRS deems necessary**.

During the inspection/audit, the FRS inspecting officer should collect any information required to meet local operational planning needs, ie environmental risks, new dimensions, Fire Service Emergency Cover data, access, water supplies, firefighting hazards, etc and update the Service information systems as necessary.

Inspecting officers should also consider whether the premises are subject to, and compliant with, the Dangerous Substances (Notification and Marking of Sites) Regulations 1990 (referred to as the NAMOS Regulations).

The NAMOS Regulations require the person in control of any site or premises where a total quantity of 25 tonnes or more of dangerous substances is used or stored, is to become used or stored, to give written notification to both the FRS and the Health and Safety Executive. The Health and Safety Executive is the enforcing authority for notification of the storage of dangerous substances and once notified, the fire authority is the enforcing authority for the marking of sites with warning signs. The fire authority is responsible for giving directions as to the quantity, type and location of signs (see Figure 2.15).

Note
Some exceptions exist.

Figure 2.15

Warning signs required by the NAMOS Regulations at a BASIS site.

2.6.4 Guidance for store holders

Those involved in the sale, supply and storage of pesticides approved for agricultural use must comply with the *Code of Practice for Suppliers of Pesticides to Agriculture, Horticulture and Forestry*, otherwise known as the 'Yellow Code'.

The Code recommends that environment agencies, the FRS and others should be consulted during the planning of a new store or the redesigning of an existing one (see Figure 2.16). Once a store has been built or commissioned, storeowners must notify the environment agency and the FRS in writing. All stores should hold written approval from the environment agency and the FRS issued following the primary inspection. These inspections consider means of escape, spillages of chemicals and firewater containment as well as firefighter safety.

Figure 2.16

A typical BASIS store. Store owners must notify FRSs and environment agencies once a store has been built or commissioned.

2.6.5 Contingency planning

Site operators who have complied with the registration scheme conditions will have a contingency plan for in-store and out-of-store spillages and fires. Employees will also be trained in the correct response to incidents.

The contingency plan, which should be kept away from the risk area and be provided to the FRS on arrival (also see Section 2.3.5) should include:

- Detailed plans of the buildings and drainage systems
- A current stock list of chemicals stored and the maximum quantities likely to be held at any one time
- Contact details of a suitable waste disposal contractor able to deal with emergency disposal operations
- Name, address and telephone number of an out-of-hours contact.

2.6.6 Drainage systems

On new sites, drainage systems outside the store containment areas should be provided with a cut-off valve for use in the event of firewater exceeding the capacity of the containment system, etc. Such valves should be clearly identified on the site drainage plans, and provided with durable on-site notices (see Figure 2.17).

On existing sites, if valves cannot be installed, pipe blockers should be available in safe storage away from the main store and their whereabouts should be clearly marked and the position shown on the site plan.

Drain mats, sandbags (made of durable material) and absorbent materials should be held in safe storage away from the main store (in addition to any absorbents held within the store for 'routine' purposes).

Figure 2.17

A remotely operated cut-off valve operated by a remote switch at a BASIS site.

Note
Other agencies also have an interest in contingency planning at BASIS sites, such as Environmental Health Officers, water companies and sewerage undertakers.

2.6.7 Additional pollution control aspects of pesticide stores

From a pollution prevention viewpoint, a pesticide store (whether registered under BASIS or not), is treated as an industrial building containing chemicals potentially capable of causing serious pollution of surface and groundwaters. The relevant pollution prevention and control policies will be applied by environment agencies, taking into account the individual circumstances of each case.

The general principle currently applied to pesticide stores is of secondary containment (see Figure 2.18) for each storage building, with some provision for emergency tertiary retention encompassing adjacent yards, access-ways and drainage systems. Some compromise may be required for existing stores but must be acceptable to environment agencies. A controlled burn may also need to be considered if it is not possible to contain all the firewater and there is a consequent risk of serious water pollution and/or a controlled burn will reduce air pollution due to the better combustion and dispersion of pollutants (see Section 3.6, Controlled burn).

The presence of certain materials may affect the FRS's strategy of dealing with a fire on site, which in turn could lead to different environmental consequences. It is a matter for the FRS to make a decision which strategy (eg controlled burn, offensive, etc) should be referred to in the store emergency response plan.

Figure 2.18

(A & B) Secondary containment at a BASIS store will usually involve a ramp over entrances and a bund around the perimeter of the building.

2.7 High-risk open-air storage sites – operational planning guidelines

This section is designed to provide guidance to FRS managers who are preparing operational plans, advising site operators or enforcing authorities on open-air bulk storage facilities. Site storage restrictions can assist in limiting the fire spread between stacks, to buildings within the site boundaries and to surrounding properties (see Figure 2.19). By limiting the fire spread and consequential need to extinguish larger fires, damage to the water, terrestrial and air environment can be reduced. Additionally, public and firefighter safety can be improved.

Reference should also be made to relevant fire safety and health and safety legislation regarding flammable stacks and employee safety. Local legislation can apply to such storage and this should also be referred to. Any storage of waste materials (eg tyre or refrigerator stacks) is governed by legislation enforced by environment agencies and they should be consulted in the first instance.

Also relevant to storage facilities is the issue of controlled burn. Section 3.6 should therefore be read in conjunction with the information below.

Table 2.4 Calculation of the separation distance in stacks

	Diameter	Distance
Enter diameter of stack (or equivalent linear length) (metres)	6	
Enter radiant heat ingition (kw/m^2)	12.5	
Equivalent diameter M (metres)	6.769836	
R Value, including diameter of stack	7.780102	
Stack separation (metres)		**4.395184**

Please note

1 The stack size is presumed as a cylinder with a correction factor giving the equivalent diameter; the program allows the parameters such as radiant heat, separation distances and diameter of the stack to be calculated.

2 Radiant heat equivalent is based on the sustained ignition of a timber surface from a pilot source in kw/m^2.

Separation distances for flammable stacks

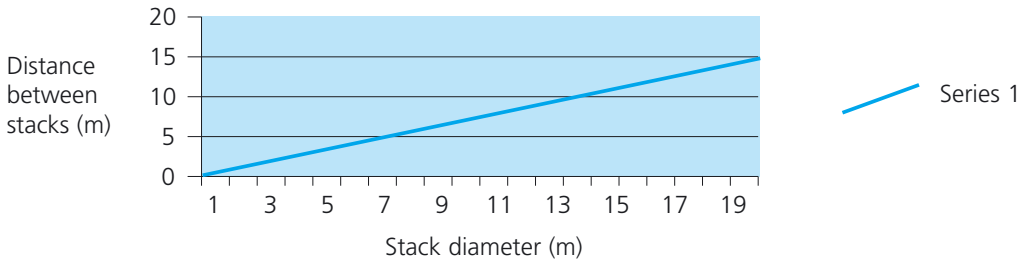


Figure 2.19

The environmental impact of fires at bulk storage sites, such as stacks of used fridges, can be limited by applying restrictions on stack sizes and separation distances.

Photo credit – Greater Manchester Fire and Rescue Service

The following guidance can be followed when planning safe site storage.

Materials should be stacked at distances that will limit the growth of large fires and the spread of fire between stacks and to nearby buildings and property. Separation distances should be calculated using the calculations outlined in Table 2.4. An example of a typical stack size and proportional distance is shown. The calculation used for separation distances between stacks and between stacks, buildings or property is:

qrad = 15.45(R/D)-1.59

Where qrad = incident radiated heat flux
15.4 = constant for heat release rate from fire
R = distance to target from centre of stack
D = Diameter of the stack (equivalent)
–1.59 = proportionality constant[1]

Assuming that the maximum allowable radiated heat incident upon an adjacent body to be 12.5 kW per square metre (piloted ignition for wood).

The calculation is based on broad assumptions and is considered suitable to apply as simple heat release models for determining stack separation distances. More detailed examinations of heat release models are available in published literature.

Detailed and site-specific advice on means of escape, adequacy of water supplies for firefighting and fire appliance access should be formulated by FRSs locally.

1 Shokri M and Beyler CL 'Radiation from large pool fires'. *Journal of Fire Protection Engineering* 1, 141–150 (1989)

2.7.1 Fire safety legislation

Stacked storage sites may be deemed to be a workplace and accordingly should comply with the Regulatory Reform (Fire Safety) Order 2005. Compliance with the recommendations outlined below should assist in meeting the requirements of the legislation.

Where combustible materials, such as tyre stacks, are stored as a result of actions arising from the treatment of end-of-life vehicles (see Section 2.9), a waste management licence or permit is required and enforced by environment agencies or local authorities.

Fire safety officers who comment on planning applications for such waste sites should consider making recommendations at the time that fire safety provisions are made in line with this section of the manual.

It is open to the local planning authority to impose conditions requiring adequate provision of water supplies for firefighting as well as the normal requirements of the Town and Country Planning Act 1990. However, when assessing the requirements for the fire safety of the employees and site conditions the adequacy of local water supplies for firefighting should be confirmed. Provisions for limiting fire spread, access for firefighting appliances and firefighter safety should also be considered and can be included in the requirements of a waste licence or other permit.

Consultation should take place with all relevant enforcing authorities including environment agencies for the purpose of permitting licensing and/or planning approvals.

Table 2.3 is a checklist that can be used by FRS managers when considering the implications of fires within stacked materials in the open air. Additionally, the safety of firefighters and the public is addressed.

Figure 2.20

Open-air storage of waste such as tyres is controlled by either licences or permits issued by environment agencies.

Photo credit – Environment Agency

Table 2.3 Checklist to assist FRS personnel when assessing the risk to the environment from open-air stacked storage facilities

1 Description of site

- How are the materials/units stacked?
- Number/quantity of materials/units on site?
- Is the material combustible or do units contain combustible material (eg insulation materials)?
- Are any processed or recovered materials stored prior to disposal?
- Are there suitable firebreaks between stacks?
- Are the distances between stacks and buildings or other structures sufficient to limit fire spread from radiated heat?
- Is there suitable and sufficient first aid firefighting equipment and trained staff?
- Are the means of escape in case of fire between stacks and from the site adequate?
- Is there access around the stack perimeter for firefighting appliances and operations?
- Is there an adequate water supply available for firefighting?
- Is there a site plan available for use by the FRS for operational planning?

2 Open water and hydrants for firefighting

- Is a hose layer appliance required, should a fire occur at the facility?
- Are suitable open water supplies identified and available?
- Have hydrant locations been identified?
- What are the expected flow rates from the hydrant supply?

3 Access

Is there potential for restrictions to access caused by:

- Prevailing winds causing smoke and fumes around access areas?
- Terrain?
- Buildings?
- Security fencing?

4 Environmental considerations

- Is the site drainage adequate, and where is the likely destination of a spillage and/or firewater?
- Local watercourses – vulnerability?

Table 2.3 *continued*

- Groundwaters – vulnerability?
- Where is the destination of adjacent culverts?
- Where is the nearest sewage treatment works, and does it have a capacity to contain fire water run-off?
- Are there suitable firewater containment facilities?
- If firefighting foam is likely to be used, can suitable containment take place?
- If firewater cannot be contained is a controlled burn a suitable operational strategy?

Wind direction

- Are there surrounding properties and residential areas that might be affected by smoke in prevailing winds?
- Is there planned advice to tenants and occupiers concerning keeping doors and windows closed, etc?
- Has plume modelling information been considered in advance to identify vulnerable populations, eg hospitals, schools, and residential homes?

5 On-site personnel

- Is there a plan to ensure evacuation of site workers?
- Has firefighter safety been considered within the stack design, should a fire occur?
- Has potential fire development on and around the site been assessed and the operational plan formulated?

6 Rendezvous point(s)

Location of fire and rescue service primary and secondary rendezvous points and Incident Command location bearing in mind the slope of the ground and prevailing wind.

When considering rendezvous points:

- Are they located appropriately?
- Do they provide sufficient space for PDA?
- Do they have marker plates provided?
- Are there alternative locations?

2.8 Training

One key element to the successful implementation of the FRS and environment agency partnership has been the development of training courses and supporting materials. These have been designed for FRS personnel and delivered in the UK at the Fire Service College and the Scottish Fire Training College at Gullane, as well as at regional and local levels. The courses and materials are subject to continuous review and the appropriate establishment should be contacted for details of its current prospectus.

This section of the manual seeks to provide information that will support the development of people in a variety of FRS roles and enable them to consider, manage and actively protect the wider environment, both at operational incidents and during other day-to-day FRS activities.

The NESG commissioned a report (OHES 2005) to examine the delivery of environmental training within the FRS. The report recommended adopting a structured approach to environmental training that could be delivered centrally, regionally, at local FRS training centres and fire stations. Based on its recommendations, this section of the manual aims to provide an outline of the identified training needs for the various roles within the FRS.

2.8.1 Firefighter

It is of fundamental importance that firefighters receive initial and ongoing training in environment protection issues. This is reflected in Unit FF5, 'Protect the environment from the effects of hazardous materials' in the firefighter role map. This unit requires that individuals understand why they are protecting the environment, how to most effectively use pollution control equipment and techniques and have knowledge of the local environmental hazards (aspects) and risks (impacts).

Figure 2.21

Firefighters should be aware of the basic concepts of environmental protection including the use of equipment such as the grab pack shown here.

Photo credit – Oxfordshire Fire and Rescue Service

During initial (Phase 1) development, trainees should acquire an understanding of the basic aspects of pollution and its impact on ecosystems, public drinking water supplies, public health and other recreational and economic activities.

They should acquire the ability to select and deploy pollution control equipment carried on fire appliances (see Figure 2.21) within the concepts provided by the 'hierarchy of pollution control' (see Section 3.2.3).

During their subsequent (Phase 2) development in the workplace they should additionally be able to select and deploy the pollution control equipment carried on specialist Environmental Protection Units or equivalent. The Environment Agency DVD *In Partnership Towards a Safer and Cleaner Environment* has been designed to support this objective. They should also be able to identify significant local environmental hazards and the risks they pose to the environment (see Section 2.3). This will include the ability to identify environmentally sensitive receptors, such as surface and groundwaters and areas where pollution could threaten drinking water abstractions and important ecosystems.

2.8.2 Crew manager

Firefighters progressing to this role will make decisions and initiate actions during the initial stages of an incident and are therefore in an influential position to prevent or reduce environmental damage.

During their development crew managers should gain knowledge of:

- Basic environmental concepts
- Pollution causes, types and effects
- Environmental legislation and the role of environment agencies
- Partnership initiatives including interaction between FRS and environment agency officers
- Pollution control at incidents explaining the source–pathway–receptor concept
- Tactical options and techniques for dealing with spillages, fire run-off, etc
- Equipment supplied by environment agencies (or others) and its effective use
- Hazards and risks to the environment which may arise from operational or other activities.

This knowledge should be augmented by:

- Appropriate case studies
- Desktop exercises involving environment protection measures
- Practical exercises using equipment.

Crew managers should additionally be able to:

- Effectively include environmental risks within the dynamic risk assessment (DRA) process
- Assign an appropriate priority to environmental protection measures based on DRA
- Develop incident management strategies using first responder pollution control equipment and identify the need for specialist equipment.

During workplace development, crew managers should gain:

- Awareness of local premises that present identifiable and significant environmental hazards and risks
- Awareness of the need to manage environmental inputs and outputs, such as water, energy and waste, in their area of local responsibility eg a fire station.

2.8.3 Watch manager

During workplace development, watch managers should gain ability to:

- Assess likely hazards and risks from local premises or facilities and plan together with other stakeholders to manage these at emergency incidents (also see the Environment Agency's Pollution Prevention Guidance No. 21 and Section 2.3.3)
- Train firefighters in the basics of environmental protection
- Manage the environmental hazards and risks of premises such as fire stations, training school, etc.

2.8.4 Station manager

During their development, station managers should:

- Identify and manage environmental hazards and risks arising from work-based activities
- Identify hazards and risks from larger, more hazardous premises, eg COMAH/ IPPC sites, and plan with stakeholders to reduce or manage these, including consideration of weight of operational response
- Work with stakeholders at the planning stage to provide engineered solutions to reduce environmental hazards and risks of premises and their contents
- Practically manage larger incidents where environmental hazards and risks are substantial

- Understand strategic environmental issues associated with incident management at larger incidents including decontamination, the use of foam, fuel storage fires, controlled burn, firewater containment and management of waste.

This should be achieved by theoretical training supported by desktop and practical exercises to reinforce environmental issues in relation to operational priorities.

2.8.5 Group manager

People operating in this role should have the ability to produce systematic environmental risk assessments of the hazards and risks in the FRS area and produce systems and procedures to mitigate risk and develop tactics to deal with associated incidents.

2.8.6 Area manager

Area managers should gain an awareness of FRS strategic responsibilities in relation to environmental risks and controls and involvement in incident command and community and partnership working issues. This should include:

- The partnership initiative, including the development of Local Working Arrangements.
- Summary of key national, European and international issues impacting on the environment, ie
  - Climate change
  - Kyoto and other international agreements
  - EU/UK legislation
  - Public attitudes
  - Likely future issues, how these are likely to be tackled and how they impact upon the FRS
  - Roles of UK and international environment agencies
  - Risk-based environmental regulation
- Legal and moral issues associated with FRS actions at incidents and the working relationships with environment agency personnel, particularly at larger incidents.

2.8.7 Brigade manager

Strategic impact assessment including consideration of large-scale pollution events.

2.8.8 Hazardous Materials and Environmental Protection Officers (HMEPOs)

HMEPOs must have an understanding of the consequences of hazardous materials entering the environment and knowledge of the protocols and techniques which could be used to protect the environment.

FRS managers who are likely to be in command of an incident involving hazardous materials and/or environmental risk, or are likely to perform the specialist advisory role of HMEP Officer should receive specialist environmental training (see Figure 2.22). This training should supplement that received by non-specialist operational fire officers as part of their role preparation, with emphasis upon larger-scale incidents where there is significant environmental risk.

2.8.9 Training video/DVD

The environment agencies produce a variety of training aids to help increase environmental awareness in the FRS, for example its DVD *In Partnership Towards a Safer and Cleaner Environment – The Environment Agency Grab Pack*. These and other environment agency training aids can be obtained by contacting either local or regional representatives.

2.8.10 Local training initiatives

Locally arranged training initiatives have formed an ongoing if largely unstructured part of developing the partnership initiative. Joint exercises have always proved to be beneficial and can be carried out at the request of either party.

Figure 2.22

Environment agency staff at a HMEP training exercise at the Fire Service College.

Local training sessions can improve liaison between the FRS, environment and other agencies and raise awareness regarding environment protection and either party's incident response capability. Other operational issues such as equipment deployment techniques and the effective provision of incident command support can also be addressed.

Training of this nature should be undertaken by anyone who might become involved in dealing with emergency incidents, including hazmats specialists. Training activities should address local information and environmental sensitivities and vulnerabilities, which will be of specific interest to participants.

2.8.11 Environment agency officer training

Training sessions for environment agency officers can provide them with an awareness of FRS Incident Command issues and incident ground protocols. A number of environment agency officers have already benefited from participating in local FRS awareness/familiarisation training sessions or courses at the Fire Service College. This training/experience should be encouraged and supported by FRS managers.

2.9 The End-of-Life Vehicle (ELV) Regulations 2003

In November 2003 the End-of-Life Vehicle (ELV) Regulations were enacted. The aim of the Regulations is to reduce or eliminate the environmental impact caused by polluting materials contained within scrapped road vehicles. Part VII of the Regulations deals with the storage and treatment of waste motor vehicles and only applies to England and Wales but is replicated by the End-of-Life Vehicles (Storage and Treatment) (Scotland) Regulations 2003, which came into force in January 2004. The Regulations are enforced by environment agencies in the UK. The Regulations are relevant to the FRS because of their use of end-of-life vehicles to simulate the rescue of trapped persons involved in RTCs. Figure 2.23 depicts a typical RTC training event.

The Regulations effectively control the disposal of vehicles that have been declared as waste (scrap) and their polluting contents as well as ensuring that they are depolluted in an environmentally effective way. A vehicle will become waste when it has been discarded, or is intended or required to be discarded, for example, by its owner. Vehicles recovered by local authorities will normally become waste after the statutory period for retaining them expires.

The ELV Regulations require all facilities (ie scrap yards) wishing to store, dismantle and depollute vehicles to obtain a licence/permit. Permitted/licensed vehicle dismantlers are known as Authorised Treatment Facilities (ATFs). The permits/licences specify the conditions under which the storage and depollution may be undertaken in order to minimise the risk of pollution to the environment or harm to human health (including from fire). Additionally, transportation of such vehicles must be by a registered waste carrier.

Figure 2.23

Photo credit – Oxfordshire Fire & Rescue Service

Legal requirements are in place to control the storage and treatment of scrap vehicles including those used for RTC training.

2.9.1 Impact of the ELV Regulations on FRS RTC training

The ELV Regulations effectively make it illegal for FRSs to store or dismantle scrapped vehicles unless they have first been depolluted. This provides two options for FRSs who wish to use scrapped vehicles for training:

- Depolluted vehicles can be obtained from a permitted/licensed ATF and delivered to fire stations and collected after use
- Crews might visit licensed/permitted ATFs to undertake training on depolluted vehicles.

FRS vehicle workshops are not allowed by the Regulations to depollute scrapped vehicles unless they themselves become an Authorised Treatment Facility, which will not normally be economically viable.

FRSs may wish to obtain vehicles which have not been scrapped and are not therefore subject to the ELV Regulations. However, during RTC training it is inevitable some fluids contained within the vehicle, such as engine oil, coolant, brake or clutch fluid, suspension fluid, will become spilt. If such fluids enter drainage systems it is possible that pollutants will enter the main sewer and/or eventually a watercourse or groundwater. This can occur even if separators (also known as interceptors) are

installed on site because separators only retain floating liquids such as oils, while other liquids such as coolants pass through the system (see Section 1.6.5, Oil separators). Consequently, FRSs should be aware that offences under pollution control legislation (see Section 1.4) might be committed in these circumstances.

If FRSs do wish to use such vehicles they will therefore need to ensure that drainage from these areas passes either to:

- A fully contained bunded training area with any spilt liquids subsequently collected by a registered waste carrier (the preferred option), or
- The public foul sewer, subject to the consent of the local sewerage undertaker.

FRSs will also need to ensure that after use the vehicle is passed only to an appropriately licensed/permitted ATF and that they make it clear that depollution treatment is still required. The necessary DVLA paperwork will also have to be completed.

Further advice on the management and disposal of ELVs or containment facilities that may be required should be directed in the first instance to the relevant environment agency.

2.10 High-volume pumps (HVPs)

High-volume pumps (HVPs) have been supplied to FRSs as part of a review of civil contingency arrangements by the UK Government. The primary function of the units is to deal with the movement of water at flooding or other incidents with the potential to cause flooding, eg possible embankment failure. Specific procedures have been drawn up between the FRSs and environment agencies for these situations. HVPs may also be used to provide water for firefighting purposes. When water for the pumps is taken from surface waters care must be taken not to over-abstract as this can place ecosystems and drinking water supplies at risk. On every occasion that HVPs are used to abstract water for firefighting purposes, the appropriate environment agency must be notified.

An additional FRS use of HVPs is at incidents where contaminated water or other products with the potential to pollute need to be pumped to an environmentally safer location, such as a containment tank or lagoon. Table 2.5 provides some possible uses for HVPs and other fire service pumps (eg light portable pumps) at pollution incidents but is not intended to be exhaustive.

Any proposal at planning stage to use this equipment at operational incidents should be subject to a generic risk assessment, supported by suitable safe systems of work and training. Before use, a dynamic risk assessment, including the acquisition of suitable technical advice – for instance, from a HMEPO or product specialist – should be carried out and recorded.

Figure 2.24

High-volume pumps (HVPs). Although designed for flood water removal, HVPs can also be used to transfer pollutants or run-off water, subject to a risk assessment.

Environment agencies maintain a range of pumps at various locations in the UK. These can be operated alongside FRS pumps to support, supplement or replace FRS pumps at more protracted incidents.

The transfer of pollutants from one location to another would not normally be an FRS function except as an operational tactic during the emergency phase of an incident. Additionally, where harmful or more hazardous products are involved, such tactics should only be considered in circumstances where the benefits outweigh the potential risks and are documented in a written risk assessment. During FRS activities where there is an operational need to transfer product to reduce or prevent environmental impact, environment agencies will work with FRSs to achieve a satisfactory outcome.

The technical specification of each HVP is:

- Capacity: 7,000 l/min (7 m^3/min, 420 m^3/hr, 116 l/s)
- Lift: 60 m
- Hose length per HVP set: 3 km
- Hose diameter: 150 mm
- Hose fittings: manifold with 150 mm storz coupling to FB standard 70 mm hoses
- Pump drive: hydraulic
- Dimension of strainer holes: 7 mm
- Required attendance: 5 persons minimum (for deployment).

2.10.1 HV pumps decontamination

LEGAL ISSUES

There is no defence if pollution is caused following decontamination of FRS equipment under the terms of the Water Resources Act 1991 or equivalent. Guidance on the decontamination of FRS equipment following a flooding or pollution event has been drawn up by the NEOG. Namely:

2.10.2 Procedures

1 PUMPS/APPLIANCES

Wash down in designated areas at fire stations that have systems that discharge to foul sewer. If drainage is not available pumps/appliances should be taken to a purpose-built vehicle cleaning centre, eg for lorries/coaches.

2 PIPEWORK/HOSES/COUPLINGS

If used for pumping river water it is unlikely that they will need to be decontaminated. Flush with hydrant water. No need to contain.

If used to pump floodwater, with low level of contamination suggest flush through with clean water from hydrant. Discharge to foul sewer following approval of sewerage undertaker.

If pipework/hoses etc are heavily contaminated, eg sewage, FRSs may decide for health and safety reasons to decontaminate with detergent or bleach. In these instances, ensure only 'confirmed' contaminated equipment is externally decontaminated, eg that which has been used in contaminated water. The run-off from the decontamination process and any flushwater used to clean pipework/pumps/hoses internally will either need to be contained and removed by registered waste carrier, or be discharged to foul sewer with the permission of the sewerage undertaker.

FRSs should carry out risk assessments to determine the possible effects that bleach or detergent might have on the equipment and source suitable products for this purpose.

Local liaison with environment agency officers and sewerage undertakers is an essential element of the system proposed above.

Table 2.5 Possible uses of high-volume and other pumps at pollution events

Type of pollutant	Example situation	Destination of material	HVP or other pump use suitable
Low toxicity or harmful substances	Product or firewater contained on roadway or similar	Foul sewer or containment area/tank	Yes, with permission of sewerage undertaker and environment agency. Consider appropriate personal protective equipment, compatibility with FRS equipment and decontamination of equipment
Organic liquids/ sludges, eg foodstuffs, silage liquor, etc	Spillage of milk contained in sewer or dammed watercourses	Open land*, foul sewer* or *containment area/tank (*Not if ground is saturated, land drains are present and/or located within source protection zone and/or conservation site)	Yes, with permission of landowner, sewerage undertaker or environment agency
Flammable liquids with firefighting water	Spilt fuel, foamed and contained in bunded area threatening to overspill	Containment lagoon, balancing pond or other containment facility	Yes, in liaison with environment agency. Avoid transfer of product itself. Only use water-driven pumps

Table 2.5 *continued*

Type of pollutant	Example situation	Destination of material	HVP or other pump use suitable
Inorganic solutions, slurries, mixtures, suspensions/ colloids	Spillage of printing ink, non-organic, or silty water or cement slurry following breach, for example, of a balancing pond at a quarry into dammed stream	Pump to foul sewer or sealed tank or balancing pond. Or for cement slurry divert to an area where it can be contained and allowed to set and then remove	Yes, with permission of sewerage undertaker or in liaison with environment agency. Consider possible corrosion and abrasion damage potential
Firewater	Large food processing unit	Recycle firewater run-off and reapply to incident	Yes, need to ensure that firewater run-off is not harmful to firefighters or would worsen the fire or safety situation

Chapter 3

Protecting the environment at operational incidents

3.1 Operational communication with environment agencies

FRSs operate a system for notifying environment agencies of incidents they are attending that have the potential to cause environmental pollution. This is undertaken routinely to comply with an element of the three-part defence required by pollution prevention legislation (see Section 1.4).

FRS Control Centres will normally report operational incidents when certain criteria are met. Examples include when firefighting foam is used, or incidents requiring four or more pumping appliances. A general guide to occasions when FRS Control should inform environment agencies is provided in Appendix 4.

Incident Commanders should consider informing or liaising with environment agencies when there is a significant risk to the environment, even if pollution has not yet occurred. Preferably environment agencies should be informed before any activity that will impact on the environment takes place. Examples of these circumstances include:

- Decontamination of personnel
- Offensive firefighting tactics
- Recovery of a damaged but intact vehicle such as a milk tanker.

It is recognised that transmission of such information to environment agencies might only be possible when operational priorities allow, but in any case should be carried out as soon as the situation permits.

Where incidents are developing, it is good practice to consult environment agency officers in good time. On occasions when risk to life or health does not exist (see Section 1.4) permission from the environment agency and/or the sewerage undertakers must be sought before any discharge of polluting material to a water body or sewerage system takes place. An example would be cleaning contaminated hose lines or pumps after the emergency phase of an incident.

Environment agencies, when informed of a polluting or potentially polluting incident by the FRS, will consider the information supplied and offer appropriate advice and assistance, initially over the telephone via FRS Control. For more complex incidents or where specific advice is required, direct communications between officers at the

incident and the environment agency should be established, normally by mobile telephone. Systems to log decisions and advice, normally with FRS Control, must also be established.

Environment agencies will endeavour to attend all incidents involving a significant or potentially significant environmental impact and may attend other incidents involving a reduced risk where the Incident Commander specifically requests their presence. An environment agency's decision to attend, or not, will be communicated giving an estimated time of arrival at the incident (see Section 3.5.1).

When FRS Control, fire station personnel or other departments receive information from landowners, premises occupiers or other members of the public that polluting activities are taking place or are proposed (eg burning of large quantities of waste or discharges of potentially polluting matter onto land or into water) they should inform the appropriate environment agency immediately and provide contact information. This will allow preventative or enforcement measures to be implemented.

3.1.1 Radioactive substances

Where it is suspected that an incident involves radioactive materials, FRS Controls must inform environment agencies immediately. Environment agencies will provide advice, as necessary, to enable the incident to be handled in the best practical, environmentally sound manner. In particular they may provide radiological advice relating to the possible contamination of drinking water sources and may authorise the disposal of radioactive waste arising. Contact with the appropriate environment agency may occur simultaneously with Radsafe or NAIR responders as appropriate.

3.2 Environmental protection operational strategies and techniques

Environment agencies recognise the unique position that the UK FRSs hold as primary responders to incidents. It is often only the FRS that can initiate early intervention to control pollution and prevent or greatly reduce damage to the environment and also minimise clean-up costs. Successful deployment of pollution control equipment may bring about a more rapid resolution of the overall incident, releasing FRS resources to attend other incidents. With the exception of Scotland, where funding is direct from the Scottish Government, environment agencies have provided pollution control equipment to the FRS. This equipment can be categorised as either 'first strike' equipment such as the grab pack designed for carriage on front-line pumps, or 'specialist equipment' designed to be carried on a dedicated vehicle or environmental protection unit (EPU). Guidance on pollution control equipment and techniques for use can also be found on the environment agencies' *In Partnership Towards a Safer and Cleaner Environment* training DVD issued free to the FRS (see Section 2.8, Training).

Standardisation has been a key development in the national equipment supply initiative. This has ensured that the most appropriate equipment for the task has been selected, that is compatible with neighbouring FRSs and environment agencies, and has simplified training requirements.

The equipment supplied to or purchased by FRSs reflects the emergency containment emphasis placed on FRS as opposed to any protracted clean-up which is not normally an activity a FRS would participate in. The polluter, their contractor or, if the polluter is not identified, the environment agency will normally undertake clean-up.

As a standard, every UK pumping appliance should be equipped with the basic grab pack. The quantity and type of additional and specialist equipment supplied to FRSs may vary depending on local environmental hazards, vulnerabilities and funding, based on a risk-assessed approach.

3.2.1 Risk assessments

The responsibility to undertake generic risk assessments for the equipment supplied by environment agencies for use by firefighters rests with individual FRSs. Risk assessments should be completed where necessary using the product data sheets and product description information provided by manufacturers. It is imperative that these risk assessments link with other associated safe systems of work (operational procedures) such as those for hazardous materials incidents.

3.2.2 Equipment list

Table 3.1 and Figure 3.1 display items of standard grab pack and additional and more specialist pollution control equipment provided by environment agencies. A catalogue of this equipment is available from environment agencies.

Note
Oil or chemical absorbing granules, powders and/or fibres are not normally provided by environment agencies.

Selection and deployment of environment protection equipment is based on breaking the source–pathway–receptor linkage (see Section 2.3). At any potentially polluting incident there may be a number of opportunities for positive intervention aimed at disrupting this linkage. A hierarchical model for such intervention is provided in Figure 3.2.

The hierarchy aims to bring about containment of polluting materials at the earliest opportunity to minimise both quantities lost and spread of contamination. This is used to bring order and control to an uncontrolled event utilising existing resources/

Table 3.1 Standard grab pack and more specialist environment protection equipment

Grab pack equipment

Grab pack bag (empty)

Laminated instruction sheet

Ready-mixed leak sealing putty in collapsible tub

Disposable clay drain sealing mat (45 × 45 cm)

Oil absorbent pads (45 × 52 cm approx)

Polyboom (yellow) × 10 m length

Plastic waste bag (approx 120 × 180 cm)

Cable ties × 2

'Miscellaneous' hazard diamond (self-adhesive) (100 mm)

Roll of warning tape

Pop-up pool (optional)

EPU equipment

Supply of individual grab pack contents in greater quantities

Polyboom – 100 m length

Overpack drums (various sizes 114–360 litres) (with castellation)

Pop-up pools (100 or 250 litres) (these may also be carried on front-line appliances)

Flexi-tank

Flexi-tank liners

Water turbine pump (peristaltic pump)

Chemical and oil absorbent pads (45 × 45 cm or 45 × 52 cm)

Inflatable drain blocker with lance (these may also be carried on front-line appliances)

River boom (various lengths) fitted with lines and wooden securing stakes

Figure 3.1

Photo credit – Darcy Products Ltd

Standard grab pack content.

facilities at the incident scene with the deployment of carefully selected pollution control equipment. The basic principle behind this approach is that the more dispersed the pollutant the more difficult it will be to recover (see Section 1.1.2).

All five stages of the hierarchy require a DRA undertaken within the parameters of an appropriate safe system of work and appropriate personal protective equipment (PPE) worn as recommended by the Emergency Action Code system.

3.2.3 Hierarchy Stage 1 – contain at source

The most effective intervention point is one where the source of the pollution can be controlled, bringing about a cessation or reduction in the quantity of material released. An example would be a breach in a container, tank or pipework. Intervention options might be to:

- Seal the damaged vessel using a proprietary leak sealing putty or other device
- Turn a drum into a position where the breach is uppermost thereby stopping the leak
- Where complete sealing is not feasible it may be possible to stem the flow to minimise the amount of product released
- Place small damaged containers/drums into a secure container such as an overpack drum

Figure 3.2

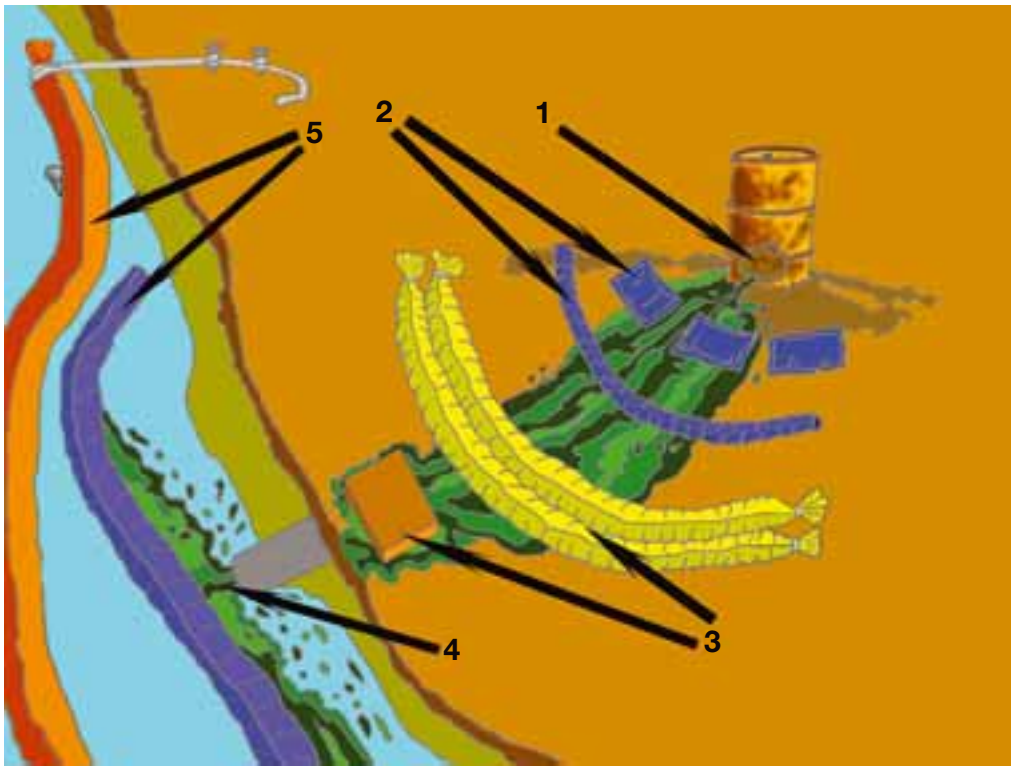


Diagram showing the hierarchy of pollution control (FSC 1997).

- Decant or transfer product from the damaged vessel into a temporary holding vessel or another tank/tanker
- Close valves on pipework to minimise further loss.

CLAY SEALING PUTTY

A collapsible tub of ready-mixed sealing putty is provided in the grab pack and can be applied to a leaking vessel. The putty, which is made from inert material so as not to react with product, is pressed into the hole using the base of the tub to form a temporary seal as shown in the sequence in Figure 3.3. The repair effected is temporary; manufacturer recommends maximum of 24 hours.

To use the putty, the screw lid should be removed wearing protective gloves. The container is then pressed firmly down and away from the user (to protect from effects of product spraying during sealing) into the damaged area of the vessel. The applied putty should not be disturbed as this may restart the leak. In situations where the surface to be sealed is torn or jagged care should be taken not to damage any PPE worn.

Depending on the nature of the container breach and the materials involved, the putty may be able to hold back pressures of around 0.25 bar or 2.5 m head.

Additional tubs of putty may be used if required, carefully removing the base of the original tub first, as can the clay drain sealing mats cut to size.

Figure 3.3

A–H This sequence shows the application of sealing putty to a leaking drum using a collapsible applicator. Note: suitable PPE should be worn dependent on the risk and appropriate chemical advice.

Figure 3.4

Inflatable leak sealing devices.

Figure 3.5

Wooden or other wedges.

PNEUMATIC LEAK SEALING DEVICES

There are a number of other methods of containing a release at source, one of which is to use inflatable rubber sealing devices, which can be wedged into areas of damage and inflated to seal the hole (see Figure 3.4). Similarly, inflatable patches can be strapped onto damaged tankers. These devices are no longer supplied to the FRS as part of environment agencies' (England, Wales and Northern Ireland) equipment supply scheme but may well be held and maintained in FRSs.

Wooden and other wedges can be found/ used by industrial FRSs (see Figure 3.5). These are cheap and simple to use and FRSs may consider their suitability for local risks based on a risk-assessed approach.

Figure 3.6

A variety of overpack drums are available from environment agencies (not Scotland) or other suppliers.

OVERPACK DRUMS

Where a damaged container such as a weeping drum or a number of smaller damaged containers are encountered it may be practical to place the damaged container into a secure holding vessel such as an overpack drum to provide further containment. Overpack drums come in a range of sizes (as shown in Figure 3.6).

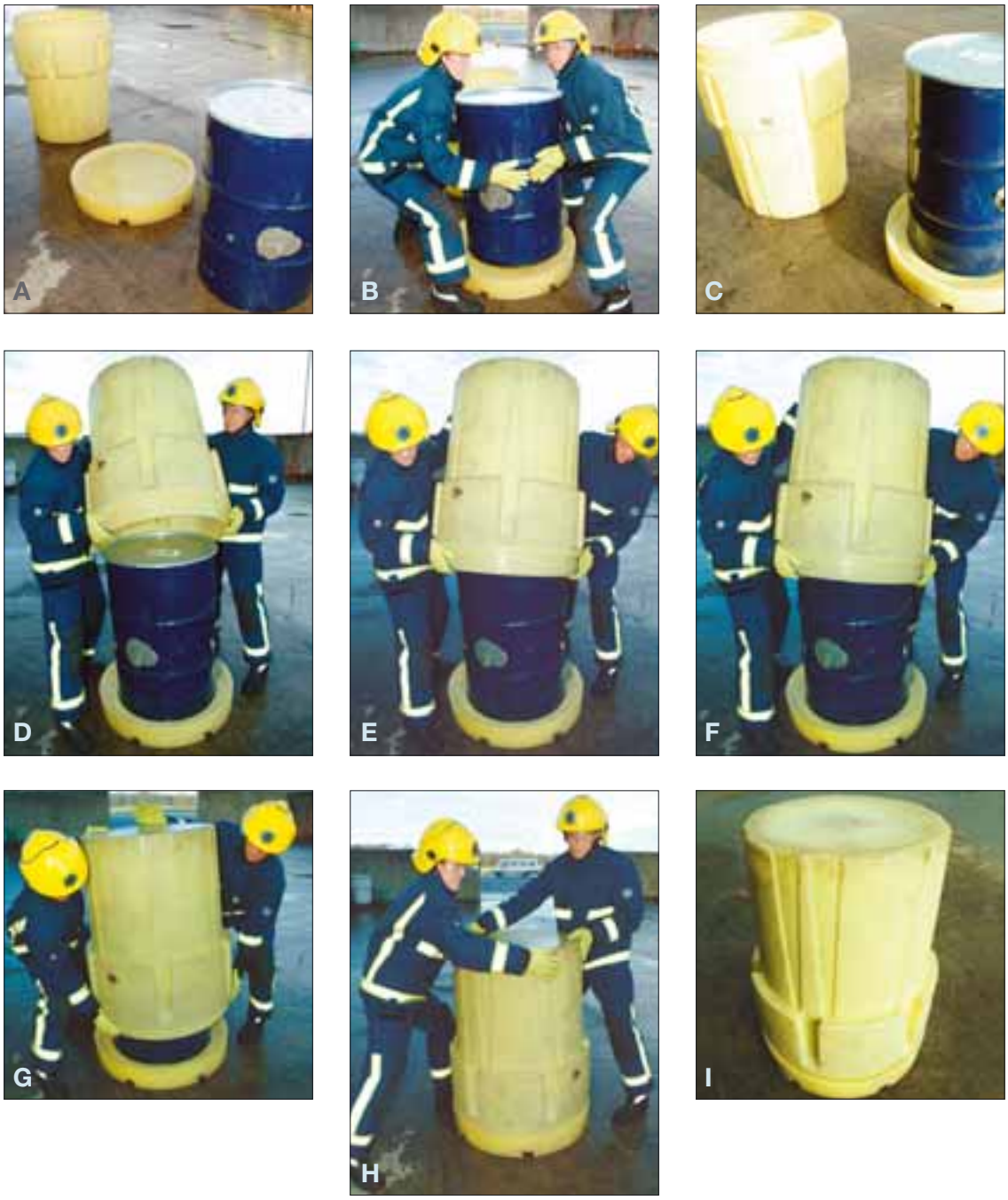
The condition of the leaking drum must be assessed before it is moved or lifted as sudden failure of a badly corroded or damaged drum is a possibility.

Small containers can be placed easily into the overpack drum, which can be closed to form a liquid and gas tight seal when the markings on the lid and body of the overpack drum align correctly. Larger or heavy damaged containers should be placed on the upturned lid of the overpack drum and the main body of the overdrum placed over the top of the damaged container and screwed down onto the lid (see Figure 3.7). Once the damaged container has been made safe in this manner it can be recovered by a registered waste carrier for disposal. The reuse of overpack drums should only be undertaken on a risk-based approach. If there is any possibility of contamination of the drum from a previous use or any residual water or cleaning material, production of heat or gas may occur as a subsequent product is added. Therefore, a strict regime for ensuring that only 'clean and dry' drums are reused must be adopted. If in doubt, dispose of the drum.

Overpack drums supplied by environment agencies will be of the screw-top variety, with castellation to allow a brace to be used to screw the lid down tightly. Steel banded drums are no longer supplied or recommended for use by FRSs but may be encountered at industrial premises or drum storage facilities. Care should be taken when FRS personnel use these drums as there is a risk of damage to chemical protective gloves as the steel band is applied/tightened.

Caution
The production of gas or vapour from a product may preclude the use of gas-tight containers.

Figure 3.7



A–I Sequence for using an overpack drum for the safe containment of a leaking drum. FRSs should ensure that they have risk assessments and a safe system of work in place for this activity.

3.2.4 Hierarchy Stage 2 – contain close to source

Where it is not possible due to the nature of the incident to contain at source, or if there has already been a significant loss of product, the next point of intervention is to contain the spillage as close to the source as possible (see Figure 3.8). A number of items contained in the grab pack or on EPUs can be used for this purpose.

ABSORBENTS

Absorbent pads/sheets, pillows, socks and booms are versatile materials widely used to contain minor spillages close to their point of release. The pads provided or recommended by environment agencies can be placed beneath a leaking vessel/tank where the loss is slight. Oil absorbent pads are colour-coded blue or white. Chemical pads which are yellow will absorb all liquids including oil and water. Oil pads will not absorb aqueous solutions and so are preferable for use on oil spills.

Loose absorbents such as clay granules, although convenient, are relatively ineffective at absorbing spillages. Whilst these absorbents are often used on small spillages, environment agencies do not supply or recommend loose adsorbents to FRSs, as they are more suited to clean-up operations rather than containment and present a particular problem with regard to waste arising.

When deployed, absorbent pads should be placed in a single layer onto a spillage and only replenished once saturated with product (see Figure 3.8). Hazardous materials still retain their hazardous properties when absorbed and this must be considered when handling soiled pads or booms etc.

A bag, cable tie and warning tape are provided in each grab pack to contain any soiled materials. Additionally, a small 'miscellaneous' UN hazard diamond should be affixed to the bag.

Figure 3.8

Stage 2 of the hierarchy – contain close to the leak, using absorbent booms and pads.

Petrol or other flammable or highly flammable liquid soaked absorbents should not be placed in sealed bags or drums and consideration should be given to not using absorbent pads on these types of spillages. If safe to do so such products should be allowed to evaporate in the open air.

A wide range of absorbent materials such as socks, cushions, loose absorbent material/fibre or clay granules may be encountered at commercial or industrial premises or at strategic locations on motorways or major roads. Colour-coding may not be uniform and care should be taken to identify the type of absorbent prior to use. Chemical absorbents will not float on a watercourse as they absorb water and will sink; similarly oil/hydrocarbon specific absorbents will not absorb water-based or water-soluble pollutants. If any doubt exists, a simple test using a bucket of clean water should be employed. Each FRS should ensure that operational personnel are familiar with the colours used within the service. Additionally, commercial premises may utilise a 'maintenance grade' absorbent pad or roll. This material, which is normally grey, is less expensive than oil or chemical coded material and will often react negatively with corrosive substances.

Chemical absorbent pads made of polypropylene, which are supplied or recommended by environment agencies, are suitable for most hazardous materials including concentrated acids and alkalis. However, they may react with oxidising agents and checks should be made with manufacturers' guidelines before use with such products. Commercial encapsulating products, supplied as a powder or granules, designed to suppress vapours/fumes and encapsulate the spilled chemical into a gel are also available commercially although these can also react with some oxidising agents.

Should improvisation be required during an incident, soil, sand and cement all have absorbent qualities. They can, however, be used to good effect to create containment barriers or bunds to minimise the spread of a spillage or firewater and keep it contained close to the source. Care should be taken to predict any reaction that might take place between the product and the material used.

POP-UP POOL

Where a more significant amount of product is involved, the pop-up pool (see Figure 3.9) can be deployed quickly and easily. The pool is positioned beneath the leaking tank, pipe, vehicle fuel tank or container, etc and can be used to contain product as it is released. It can also be used as a temporary sump prior to pumping/transfer, using perhaps a water turbine pump into a larger alternative holding vessel. The pop-up pool is provided in two sizes: 100 and 250 litres. The low wall design of the pool makes it ideal for sliding under vehicles or beneath leaking tanks/pipework. The pool can also be used during low-volume decontamination of firefighters. Care must be taken when using these pools on an incline as the capacity and stability can be reduced significantly. Additionally, the pools should not be dragged along the ground if they contain product as this will cause tears or cuts in the base fabric. The pools can be cleaned and reused if contaminated with low-hazard product such as petrol or diesel fuel. Where stowage space exists, FRS should consider carrying one pool on each front-line pumping appliance as they are designed as a rapid deployment tool.

Figure 3.9

A pop-up pool deployed under a leaking fuel tank. FRSs may wish to carry this equipment on front-line pumping appliances.

3.2.5 Hierarchy Stage 3 – containment on the surface

One of the most common ways for a spillage to enter the environment is via open drain gullies connected to the surface water drainage system. The drainage system provides a very efficient pollution pathway.

POLYBOOM

The polyboom (see Figure 3.10) is a one-use water filled boom which can be deployed on hard-standing or roadways to contain a spillage or contaminated fire run-off water or to divert such material to a designated containment area or oil separator (see Section 1.6.5). Each grab pack contains a 10 metre length of polyboom; longer 100 metre lengths are provided to form part of EPU loads (see Figure 3.11).

The polyboom's three-tube construction prevents the boom rolling if deployed on a gradient. The boom is resistant to most chemicals but may be adversely affected by very aggressive solvents such as acetone. The two large outer tubes of the polyboom are designed to be filled with water from a hose-reel or open end supply. Before filling with water the boom needs to be sealed at one end by using either an overhand knot or the plastic cable ties supplied. Once sealed, the polyboom should be laid out in the required position before filling with water as once filled the boom cannot be moved without tearing the polythene. When deploying a longer length of polyboom it is recommended that the boom be filled as it is rolled out to prevent the polyboom being blown by the wind. These booms will not be effective on porous road, car park or other similar porous surfaces (see Section 1.7.4).

Polyboom will create a satisfactory seal when deployed on a roadway or yard that is in good condition. On uneven surfaces the additional use of absorbent granules, soil or sand may help to prevent seepage of product from under the boom.

Polyboom can also be deployed across the inside of a doorway, yard entrance or similar to contain contaminated firewater within a building (see Figure 3.12). It can also be used to direct a large spillage of contaminated firewater run-off to a designated containment area/facility.

Figure 3.10

Polyboom carried in grab packs deployed in series to contain fire run-off water containing oil from a ruptured domestic heating oil tank.

Photo credit – Lancashire Fire and Rescue Service

Figure 3.11

100 metre lengths of polyboom carried on EPUs can be deployed for larger spills such as a tanker roll-over. This series of photographs shows the correct method of boom deployment.

Figure 3.12

Photo credit – Oxfordshire Fire and Rescue Service

Using polyboom across a doorway can act to contain firewater or a spillage within the confines of a building.

Figure 3.13

Photo credit – Gloucestershire Fire and Rescue Service

Firewater contaminated with chlorine based products contained by land booms.

Improvised solutions can be extremely effective; eg a charged length of hose can be used reasonably successfully as an improvised boom and soil/sand can be used to channel run-off to a suitable containment area. Additionally proprietary land booms can be extremely effective (see Figure 3.13).

CLAY DRAIN MATS

Each grab pack contains a clay mat designed to be placed over an open drain grating to form a seal thus preventing potentially polluting liquids entering the drainage system (see Figure 3.14). The clay mats are sealed in a plastic bag from which the mat must be removed before use. The mat is additionally sandwiched between two layers of plastic film to prevent the mat sticking to the inside of the bag. This film must be removed from the underside of the mat using the tab

Figure 3.14

Clay drain mat deployed.

Figure 3.15

Clay drain mats and polyboom used together as an effective strategy to prevent fire run-off water from entering the water environment.

Photo credit – West Yorkshire Fire and Rescue Service

provided, before placing the mat over the drain to be sealed. The mat should be pressed down by foot, gently around its edges to create the seal with the drain surround or surrounding concrete/tarmac road/yard surface. The film on the top side of the mat should be left in place to prevent contamination of the operator's boot.

The mats can be cut to cover unusual shaped drain gratings or gullies or overlapped to cover a larger grating. They can also be used to plug unusual shaped leaks in tanks, containers or bunds.

When setting up a containment area using the mats, for example, in a car park, consideration should be given to site gradients and finding the low point on site, to anticipate where run-off or a spillage may naturally flow. A combination of polyboom and clay mats can be extremely effective in these situations (see Figure 3.15). Large areas of hard-standing such as car parks and yards can be used to contain significant quantities of firewater run-off using this technique. At some premises areas may have been designed specifically for this purpose.

Site occupiers will often be able to assist with the location and identification of drains and may confirm the presence of drainage features such as oil separators, penstocks, treatment plants, holding tanks, etc.

Improvised solutions using soil/sand deployed around drains and even the rubber floor mat out of a vehicle weighted down with soil can be very effective at preventing product entering a drainage system.

PERISTALTIC PUMPS AND FLEXI-DAMS

Peristaltic pumps may be supplied to FRSs. These pumps are operated using a water turbine powered from FRS pumps and are provided with a number of product recovery attachments. They are ideally suited to moving product from a containment reservoir to a safer location such as a flexi-dam, pop-up pool, overdrum or improvised dam.

Once product is contained, the clean-up should be handed over to a responsible person on site, wherever possible. Only in exceptional circumstances, where a risk of further pollution and/or a danger to the public exists, should the transfer of product take place using FRS resources. Peristaltic pumps should be 'wet tested' quarterly and servicing arranged via the equipment replenishment system (England and Wales only) (see Figure 3.16).

Product contained by blocking drains can also be recovered from road/yard surfaces using vacuum tankers. If the material contained is organic in nature, such as milk, beer, sewage, etc it may be possible, with the prior permission of the sewerage undertaker (see Section 1.6), to pump the contamination at an agreed rate to the foul sewer. In certain circumstances such materials may also be pumped onto agricultural or open land at a rate which allows attenuation of organic materials in surface soils without creating run-off or risk to groundwater sources. Such pumping is not recommended if the land is waterlogged and/or there are land drains present. Landowners' permission is required and the aim is to provide nutrient to the land within the limits and restrictions set down in the Code of Good Agricultural Practice for the Protection of Water (www.defra.gov.uk).

Figure 3.16

Peristaltic pump with attachments pumping to flexi-dam.

Where a flexi-dam is used, it is essential that the dam is positioned on level firm ground or hard-standing. The floating collar on the dam allows the dam to gradually rise to its full height as it receives pumped liquid. Should the dam be positioned on a slope there is a serious risk of the dam over toppling as it becomes full of liquid. Tethers will increase stability and should be used when erecting a dam on unmade ground.

A flexi-dam liner should always be used to allow re-use. Flexi-dams should be pumped out rather than emptied from the bottom using the valve fitted.

3.2.6 Hierarchy Stage 4 – contain in the drainage system

Frequently, pollutants will be entering drainage systems before pollution control equipment can be deployed. In these circumstances, the drainage system itself can be used for containment. At other incidents, drainage systems are the preferred option for containment. An important aspect of any environmental incident management strategy is knowledge of drainage systems in the vicinity of the incident (see Section 1.6).

POLLUTION CONTROL DEVICES

Drainage features such as oil separators, penstocks, pollution control valves and firewater/spillage containment basins may be present at some industrial/commercial premises or on or near highways (see Section 1.7, PPG18 and PPG22 www.environment-agency.gov.uk). These may be used to contain a spillage within the drainage system and provide an opportunity for product recovery. The negative consequences of isolating a drainage system during high rainfall must also be considered. Local crews need to be able to identify such features where they exist and, working with owners or relevant agencies, familiarise themselves with operation. Balancing ponds/natural features are often permeable so care must be taken not to spread or exacerbate the pollution.

PIPE BLOCKERS

Inflatable pipe blockers are included in the recommended list of equipment to be carried by FRSs (see Figure 3.17). This equipment can be used in two ways. Firstly, the pipe blockers can be inserted into the open end of a drainage outfall and inflated to form a bung. Pollutants or contaminated surface water will be retained within the drainage system for recovery by tanker or peristaltic pump normally from a drainage cover or other access point. Again, the consequences of blocking a surface water drainage outfall pipe must be considered particularly during rainfall. If the drainage system surcharges (overflows) as a result of flow back-up, contamination may be spread and affect a wider area. Similarly, pressure may build up behind the drain blocker and cause it to fail suddenly.

Another use for inflatable pipe blockers is in the outflow pipe from a roadside gulley pot or oil separator or in a surface water drain at a drain cover access point. By blocking the outflow from a roadside drain the drain gulley pot becomes a sealed sump, which can be emptied using a vacuum tanker or the peristaltic pump. Such a facility can be useful where contamination is spread thinly on a carriageway and the best means of recovery is to divert the product towards the nearest sealed gulley.

Figure 3.17

A range of inflatable pipe blockers are available and may be supplied by environment agencies.

Figure 3.18

Outfall with inflatable pipe blocker on lance in use.

A pipe blocker applicator lance has been developed to enable the pipe blocker to be deployed inside a gulley pot without the user having to come into close contact with the material being contained. These operate using a bladder that can be used in pipes from 100 mm to 1,500 mm. Consideration should be given to stowing this equipment on front-line appliances (see Figure 3.18).

SEWERAGE SYSTEMS

If polluting material enters the foul or surface sewerage system, opportunities may exist to contain the contamination. This can be achieved by blocking the sewer at a drain-cover access point using a pipe blocker (being mindful of the potential consequences of backing up the sewerage system or the presence of storm overflows), using a penstock on site (see Figure 3.19), off site at a balancing road or sewage pumping station, or at the sewage treatment works (see Section 1.6).

Figure 3.19

An on-site penstock that might be used to contain product or contaminated fire water run-off within the drainage system.

3.2.7 Hierarchy Stage 5 – contain on or in the watercourse

Occasions where FRS activity extends to emergency containment of pollutants on or in a watercourse will be limited by the equipment carried, the size of the water body and the practical skills and knowledge of the attending FRS crews.

Rapid deployment of a river boom at an appropriate location downstream of an incident has proven to be of tremendous benefit where the pollutant is less dense than water and therefore floats; eg hydrocarbons, vegetable oils and some solvents. Where the pollutant is miscible with water or denser than water then other techniques can be considered, eg damming. Where drinking water abstraction points are threatened by pollutants, booms may be deployed in a semicircle around the inlet. At incidents involving moored vessels, booms may be deployed to contain fuels etc (see Figure 3.20).

Solid buoyancy booms (see Figure 3.20) are available in three-metre lengths. They require no inflation and can be joined together to form longer spans. The boom can be quickly and easily deployed and are non-absorbent and act to contain floating product to facilitate product recovery from the watercourse.

Figure 3.20

A river boom deployed around a vessel leaking fuel. Note the oil absorbent pads deployed within the boomed area.

Photo credit – Oxfordshire Fire and Rescue Service

Figure 3.21

Wooden planks being used to raise the water level in a shallow stream. With sufficient depth of water, river booms and absorbent material can be more effectively deployed.

Photo credit – OHES Ltd

Oil absorbent booms can be deployed together with the solid buoyancy boom to collect the polluting product.

There are some important considerations when deploying river booms, such as crew safety and the characteristics of the watercourse involved.

A suitable booming location should have the following features:

- Safe access to the water's edge
- Water of sufficient depth to allow the boom to hang down unimpeded into the water column
- River current must not be too fast; calm water is ideal for booming
- Good access for a road tanker to recover product retained by the boom
- Access to both banks in order to secure boom at either end if necessary
- Free from underground services which may be damaged by ground penetration during staking, eg oil pipelines or electricity cables
- Away from area used by members of the public, particularly children and/or boats.

Note
The nearest suitable booming location which meets the criteria outlined above may be a considerable distance downstream from the pollution entry point.

In small ditches and streams, a boom placed across the river and secured against the banks at each end will be effective and permit the successful recovery of product. In a wider watercourse it is necessary to angle the boom to bring product over to the preferred bank for recovery (see Figure 3.22).

Figure 3.22

Sequence for river boom deployment. Note the 'tick' shape that moves the spilt product towards the bank where flow is slower and it can be more easily recovered.

To enable larger quantities of product to be contained booms should be placed in series at suitable locations downstream of the pollution entry point.

For more protracted incidents the environment agencies will facilitate any additional or larger scale deployment of booms and their ongoing management.

In the absence or shortage of booms, planks of wood or a ladder wrapped in a salvage sheet can be placed across and into the watercourse to form baffle boards making an effective emergency boom.

DAMMING

Where water in a stream or ditch is not deep enough for booming, the water level can be raised by creating a dam/weir using sandbags (see Figure 3.23). A boom can then be deployed in the deeper water created immediately upstream. This technique allows the river water to flow unimpeded and will keep the depth above the dam/weir constant. Sandbags should be laid lengthways into the watercourse parallel to the riverbanks to create a dam, which has strength.

Figure 3.23

Sandbags being used to raise water levels to allow deployment of river booms. Additional booms are deployed in series to secure any overflow or underflow of pollutant.

Photo credit – OHES Ltd

Figure 3.24

Improvised dam using soil and a hay bail.

Photo credit – The Environment Agency

When dams are constructed it is essential that water flow continues so that the dam does not overtop, taking with it any pollutant, eg oils, which may have collected. A successful means of managing flow problems is to install drainpipes or similar at a low level during dam construction. Flow is permitted through these low-level pipes (which can be blocked using inflatable drain blockers and/or left open to permit control of water levels behind the dam). A length of hard suction hose may be used for this purpose.

In a small watercourse it may be possible to contain a pollutant downstream by damming the stream completely, using soil, sand bags, straw bales or a salvage sheet (see Figure 3.24). This technique should be considered with pollutants that mix with water. This works particularly well when the flow in the watercourse is slow as it permits the retention of a wide range of pollutants, including contaminated firewater run-off water. Once pollution is contained it can be recovered using a tanker or treated *in situ*.

Where a pollutant is heavier than water (eg some solvents) it will move along the bottom of a watercourse. A dam is appropriate in these instances as it will halt the progress of the pollutant and permit its build-up on the bed of the watercourse whilst allowing clean uncontaminated water to continue to flow over the top of the dam rather like a weir. The contained pollutant can then be recovered by pumping from the bottom of the watercourse by suction tanker or similar.

Note
Where pollution control equipment has been used to contain fuels, oils, chemicals, etc it is likely that the resulting waste will be classified as hazardous waste by those Regulations. Section 3.8 refers.

3.2.8 Additional techniques

DILUTION

Occasionally, the most practicable solution for a small spillage may be to dilute with copious amounts of water and release to the drainage system. However, there are a number of important factors for consideration before doing so. These include the nature and quantity of the pollutant, and the chemistry and sensitivity of the receiving watercourse which could vary depending on time of year, flow conditions, exact location, etc. It is important, therefore, that containment measures are utilised initially and further advice and guidance sought from environment agencies before any attempt is made to dilute.

At no time should detergent or any other cleaning products be added to spillages or spillages hosed to drain without prior authority from the environment agencies and/or sewerage undertakers.

NEUTRALISATION

A small spillage of dilute acid may be neutralised using soda ash where carried by the FRS or available on site. The responsible person for the premises etc must deal with the resulting hazardous waste. Soda ash is not supplied as part of the environment agencies' equipment supply scheme. When a neutralisation material is added to acid, a chemical reaction takes place releasing carbon dioxide. Depending on the concentration involved and the rate of application it is possible that the reaction will become energetic, ejecting product. Crews should be warned about such a reaction during pre-entry briefings.

AERATION

Organic pollutants such as milk and sewage will remove oxygen from water bodies (see Section 1.2.2). The environment agencies and a number of specialist contractors are equipped to oxygenate affected watercourses to raise dissolved oxygen levels; either physically, using aeration units which bubble air through the water, or chemically, through the controlled introduction of hydrogen peroxide. Pumping of affected water into the air through hose jets during the initial stages of an incident is less efficient but is a technique which can be used to some effect.

TREATMENT

Treatment of pollution in a watercourse, for example, using activated carbon or hydrogen peroxide, can be problematical and is a specialised technique used by an environment agency or specialist contractors.

3.2.9 Decontamination of personnel

FRS decontamination is designed to remove contamination from PPE sufficiently well to ensure that the wearer can be removed from it without them becoming contaminated. An additional consideration when decontaminating is the impact on the environment. It is essential that the appropriate decontamination method is selected that considers both the safety of wearers and the receiving environment (see Figure 3.25).

Figure 3.25

Photo credit – Lancashire Fire & Rescue Service

When decontaminating firefighters at incidents, a high dilution ratio is normally required to ensure environmental damage does not occur. However, for more eco-toxic substances such as pesticides or mercury components etc, containment is the correct strategy. No legal defence exists if pollution occurs when decontaminating equipment or appliances.

Decontamination of the public or firefighters can be considered as 'actions in an emergency to save or protect life'. Consequently it is unlikely that any offence will be committed as outlined within the various pollution prevention legislation. This is not the case when decontaminating equipment, appliances, roadways, etc. Where decontamination of persons is taking place the protection of public drinking water supplies should be paramount when considering the effects of run-off. For the majority of chemicals it has been agreed between environment agencies and FRSs that the large dilution afforded to any chemicals present on protective suits when decontamination showers are used will ensure that decontamination run-off will have minimal or no measurable environmental impact. For more toxic products, this is not the case and decontamination methods that either do not employ water or restrict and contain the water must be employed. These products include:

- Pesticides
- Mercury and mercury-based products
- Radioactive materials.

This list is not exhaustive.

Notification to environment agencies regarding decontamination is detailed in Appendix 4. Incident Commanders will normally have considered the need for decontamination and the methods available as crews are committed. It is at this time that notification to the appropriate environment agency is considered good practice.

Separate procedures have been agreed for the mass decontamination of casualties at CBRN incidents. These are set out in the Water UK document *Protocol for the Disposal of Contaminated Water* available from the Water UK website www.water.org.uk/home.

3.3 Role of the Hazardous Materials and Environmental Protection Officer

One of the pivotal roles within the command structure at hazmats and incidents with the potential to pollute the environment is the HMEPO or Hazmats Officer. At emergency incidents where there is a threat to the environment the HMEPO is often key to the successful conclusion of the event. The HMEPO will have attended the HMEP course at the Fire Service College or equivalent. Within the HMEP course an environment module (see Section 2.8) is included which provides officers with the knowledge and understanding to advise Incident Commanders on tactics and issues in relation to environmental protection.

FRSs should consider mobilising or involving HMEPOs in any incident with the potential to pollute the environment, not only those incidents involving hazardous materials. Liaison between HMEPOs and environment agency officers is normally highly productive in relation to the successful conclusion of these incidents. Incidents other than hazmats that might attract the attendance of a HMEPO can include:

Figure 3.26

HMEPOs can often be the first point of contact for advice on pollution issues.

Photo credit – Oxfordshire Fire and Rescue Service

- Spillages of organic materials, eg milk, beer, etc above guideline quantities (see Appendix 4)
- All fires with more than four pumping appliances attending and/or the use of HV pumps
- Spillages or fires involving low-hazard materials such as paints, dyes, etc above threshold quantities
- Leaks or spillages of fuel or oil, storage facilities including domestic properties or following road traffic collisions. See Section 3.1 for guideline quantities.

On all occasions that two or more grab pack contents are deployed.

Environment agency officers should also be invited regularly to training or HMEPO meetings where these take place.

It is recognised best practice for each FRS to nominate a HMEPO who has the responsibility for day-to-day liaison with a nominated environment agency officer (see Section 2.1). Such liaison will contribute to the effective and positive relationship between the two organisations and facilitate effective working arrangements.

3.4 Environmental information sources

The primary source of environmental information for UK FRSs is from environment agency officers, usually by telephone. The speed of telephone response from environment agencies – normally within 30 minutes – is useful to Incident Commanders who may need specific environmental information. HMEPOs can provide general advice on these matters, especially where an Emergency Action Code is assigned to the product(s) involved. More detailed advice can also be obtained from scientific advisers or from the CHEMSAFE Longstop service provided by the National Chemical Emergency Centre (NCEC) at Harwell, Oxfordshire. There are, however, a number of electronic information sources that will provide environmental information and these can also be useful during an incident.

3.4.1 Chemdata

The primary emergency chemical information retrieval system used within the UK is the 'Chemdata' system provided by NCEC. Within a range of product information sheets, NCEC has introduced an environmental priority section that will be useful for FRS personnel during planning and operational situations.

The environmental priority phases within Chemdata are:

- **High priority** – prevent entry into the environment as effects are likely to be severe and long-term, eg prevent surface water run-off, seal drains

- **Moderate priority** – effects may be significant in the short term but are not likely to be persistent except in environmentally sensitive location; eg prevent surface water run-off, seal drains
- **Low priority** – unlikely to cause severe or long-term harm in the environment except in environmentally sensitive locations. Minimise surface water run-off.

Other chemical information retrieval systems, such as the London Fire Brigade's Chemical Information Retrieval and Update System (CIRUS), provide general advice on environmental issues associated with hazardous materials.

3.4.2 Internet resources

HAZMASTERG3 – INTEGRATED HAZMAT/CBRN DECISION SUPPORT SYSTEM

www.hazmatlink.com

This software can be operated on a desktop, laptop or handheld computer with full reach-back capabilities to a number of web-based resources from an internet connection. HazmasterG3 covers chemicals, biological and radioactive substances and contains chemical and physical data, reactivity information, advice on personal protective equipment, downwind protective distances and environmental hazard information.

CHEMIDPLUS

chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp

A comprehensive meta-search site combining links to a number of different websites with information related to polluting substances. These include:

- Hazardous Substances Data Bank
- International Toxicity Estimates for Risk
- International Chemical Safety Cards
- European Inventory of Existing Commercial Chemical Substances.

HAZARDOUS SUBSTANCES DATA BANK

toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen/HSDB

This data bank is organised by chemical record and covers the toxicity and biomedical effects of chemicals. The file is enhanced with data from such related areas as emergency handling procedures, environmental fate, human exposure, detection methods, and regulatory requirements. HSDB contains complete references for all data sources utilised. The file is fully peer-reviewed by the Scientific Review Panel, a committee of expert toxicologists and other scientists. HSDB is built, maintained, reviewed and updated on the NLM's Toxicology Data Network (TOXNET). This database contains information for handling and clean-up.

EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES

ecb.jrc.it/esis/

This database is a registry of existing substances registered with the EU. It is useful for identifying risk and safety phrases as well as who the major producers are of the substance within Europe.

INTERNATIONAL CHEMICAL SAFETY CARDS

www.ilo.org/public/english/protection/safework/cis/products/icsc/
dtasht/index.htm
These summarise essential health and safety information on chemicals for their use in the workplace. Provide a useful one-page summary of the substance and contain some basic environmental data.

PESTICIDE REGISTER

secure.pesticides.gov.uk/pestreg/ProdSearch.asp
This resource can be used to identify pesticides that are registered for use in the UK. Details are provided on the active ingredient and which company registered the product.

SIRI MSDS INDEX

hazard.com/msds/
The database is probably one of the largest publicly accessible collections of MSDS on the internet. The information tends to be for products manufactured by American companies but is still useful as many of these products are also found in the UK.

CEFIC ERICARDS DATABASE

www.ericards.net/
The CEFIC Emergency Response Intervention Cards (ERICards or ERICs) provide guidance on initial actions for FRS when they arrive at the scene of a chemical transport accident without having appropriate and reliable product specific emergency information at hand.

ERICards are intended for fire crews, trained in chemical emergency response, and contain information and procedures that may require specialised equipment. ERICards are intended to deal with chemical accidents involving a substantial amount of product, occurring during land transport only, and may therefore not be appropriate for accidents in other situations.

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM (CHRIS)

www.chrismanual.com/Default.htm
CHRIS is the database used by the US Coastguard in responding to chemical incidents. It is particularly good at providing information about the risk to the aquatic environment.

WISER

www.wiser.nlm.nih.gov
WISER contains some detailed environmental data.

3.5 Environment agencies' response to incidents

Environment agencies' response to pollution incidents is one of the most important aspects of their work. This section outlines environment agencies' response procedure when attending FRS incidents.

3.5.1 Assessment and attendance

The agencies operate 24-hour communications centres. Calls from the public and emergency services are directed to the communications centres or an area office where they are logged and passed to the appropriate office during office hours, or outside office hours to a standby officer from the relevant function. There are dedicated lines for the emergency services. Once a call has been passed on to a competent agency officer they will make a professional assessment on the seriousness of the incident and decide on the response required. This will often necessitate a return call to the FRS to ascertain further details.

Where immediate attendance is deemed necessary, eg a serious pollution risk or where the agency attendance is specifically requested and is justified, the officer will endeavour to be on site within two hours during office hours and four hours outside office hours. In most cases officers usually attend the scene of an incident within an hour. However, environment agencies are not 'blue light' services, and therefore delays should be anticipated. When environment agency officers are en-route, the FRS has access to telephone advice, although this should be confirmed before the officer begins their journey. In all cases the environment agency officers should provide an estimated time of arrival.

In many cases the incident will be judged non-urgent and will be dealt with by the next working day or at the first convenient opportunity. In other cases attendance may be deemed unnecessary; for example, a report of a small acid spillage, or FRS intervention has already contained the pollutant, removing the threat to the environment. In these cases the environment agency should always inform the FRS of its chosen course of action.

3.5.2 Environment agencies' scene protocols

On arrival at the scene where the FRS is in attendance, the environment agency officer's first task will be to make themselves known to the FRS Incident Commander. Depending on the situation, they will assess the scene and offer appropriate advice to prevent or mitigate pollution.

In cases where the source of pollution is unknown, the environment agency officer's task will be to locate the source, as well as to prevent and/or mitigate further effects. In all cases, even if legal action is not taken, detailed records of the resources expended will be kept, as the environment agency will usually seek to recover its costs. Environment agencies are also responsible for advising on and regulating the management of any waste arising at an incident, but not for its disposal (see Section 3.8).

3.5.3 Specific roles of environment agency staff

Environment agencies' incident management procedures require their officers to assume roles such as site controller, base controller and competent officer. When dealing with non-complex incidents these may be the same individual. In a major or more complex incident, different officers will undertake these roles. The roles are as follows.

COMPETENT OFFICER

The competent officer is the technical/functional officer who receives details of the incident from the communication centre. Their key role is to assess the information and determine the environment agency's response.

THE SITE CONTROLLER

The site controller, in liaison with the base controller, will be the environment agency officer responsible for the co-ordination of the environmental response at the scene of the emergency. The site controller will be recognisable by a labelled tabard and will act as the primary point of contact for the Incident Commander (see Figure 3.27).

THE BASE CONTROLLER

The base controller is normally an experienced member of staff who is responsible for the overall control of the incident. They commonly operate from the nearest environment agency office but will move to an area or regional incident room if the event is of sufficient magnitude. They will be responsible for directing the environmental response and providing support services to the site controller and field staff at the incident scene. Other duties include mobilising external and internal resources at a regional and area level.

Figure 3.27

Environment agency officers will attend emergency incidents where there is a serious threat of pollution or on request of the Incident Commander.

Photo credit – SEPA

Note
The competent officer, site controller and base controller system does not operate in Scotland.

3.5.4 Categories of pollution incident

The environment agencies deal with pollution incidents involving a wide variety of sources, pollutant types and size.

The environment agencies classify environmental impact into four incident categories. The most serious of these is a Category 1, the least a Category 4. Category 1 incidents are rare and the numbers are decreasing, but their effects are significant and could involve the justifiable closure of public drinking water intakes; major fish kills; destruction of other aquatic fauna and flora; major media interest and extensive clean-up costs. Prosecution of the polluter usually follows these events.

3.5.5 Pollution prevention

Environment agencies are keen to prevent pollution rather than dealing with its result. They have developed a number of pollution prevention initiatives, one of the most successful being the FRS initiative.

These are backed up by a series of national guidance notes known as Pollution Prevention Guidance (PPGs) which are available free of charge from agencies. These can be found at the agencies' website www.environment-agency.gov.uk.

3.6 Controlled burn

A controlled burn is a defensive operational strategy to prohibit or restrict the use of extinguishing media on fires so that damage to the environment is minimised (see Figure 3.28). In some cases this strategy can act to protect public health, as an Incident Commander may choose to use a controlled burn strategy when there are significant risks to public drinking water supplies.

Note
This section does not relate to controlled burn of moorland, heathland, etc, agricultural or other waste.

This operational strategy will normally be used to prevent water pollution but when applied may also benefit air quality due to the improved combustion and dispersion of airborne pollutants.

Figure 3.28

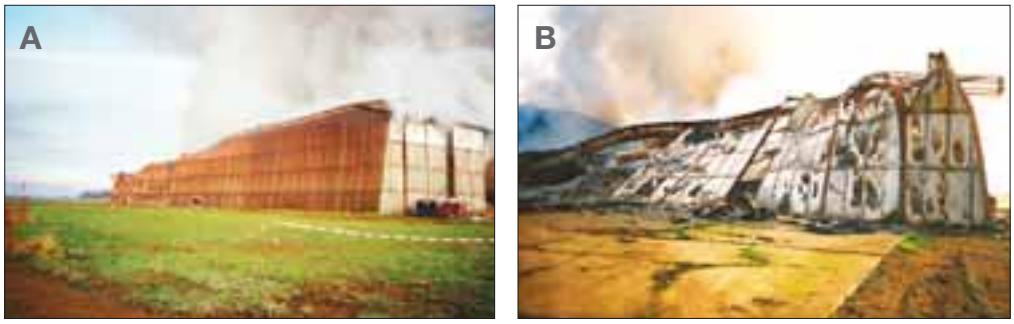


Photo credit – Oxfordshire Fire and Rescue Service

Controlled burn is a strategy that can be employed by Incident Commanders, although ideally the decision to adopt this strategy should be made at planning stage. Note the absence of firewater run-off.

Conversely, it may have adverse impacts, such as allowing or increasing the formation of hazardous gaseous by-products. The balance of potential water and airborne impacts is one of the factors that must be taken into account before the strategy is used. Ideally this decision should be made at the planning stage. The protection of people will always take precedence over environmental considerations. Incident Commanders may also decide to adopt a controlled burn strategy where there are significant risks to FRS personnel from offensive firefighting tactics.

This section provides guidance on determining the circumstances where controlled burn could operationally be employed. Liaison with site operators, environment agency officers and other stakeholders provides FRS managers with an opportunity to plan for the use of a controlled burn strategy. Planning for a controlled burn strategy is also considered within Sections 1.2 and 2.1.

Controlled burn strategies will principally apply to industrial or commercial premises processing or storing polluting substances but it can also be useful to mitigate the effects of fires involving:

- Agricultural premises, eg barns or BASIS (Registration) Ltd stores
- Transport by road, rail or sea of hazardous and/or environmentally damaging materials in significant quantities.

3.6.1 Guidance on planning

For sites falling under the Control of Major Accident Hazard Regulations 1999, Environmental Permitting Regulations 2007, Pollution Prevention and Control Regulations 2000 and other relevant environmental legislation, this guidance should supplement but not replace any statutory requirements and guidance provided by this legislation.

Planning, with site occupiers and environment agencies, to employ a controlled burn may be required as part of:

- An industry inspection scheme such as the BASIS (Registration) Ltd scheme for agrochemical stores
- An incident response plan at a site regulated by environment agencies
- An environmental management system (eg ISO14001), or as an agreed environmentally best option as part of the integrated risk management process (IRMP) or equivalent.

The plan should consider both the event and post-event phase of the incident and the actual arrangements for mitigating pollution and informing the local population. Additionally, where appropriate it should cover air and water monitoring arrangements both on- and off-site.

Further guidance on preparing an incident response plan is given in PPG 21 (www.environment-agency.gov.uk).

This guidance is not applicable to fires involving sites storing radioactive materials/ wastes covered under the Radioactive Substances Act 1993, as control of pollution from fires at such sites will be considered as a requirement of this legislation.

3.6.2 Operational considerations when determining the suitability of a controlled burn strategy

During the planning stage, or when an Incident Commander at a fire is considering a controlled burn strategy, a number of issues need to be considered.

Saving or protecting people will override environmental and other considerations such as the protection of property.

Where an offensive firefighting strategy is required to prevent a fire escalating and significant environmental risks exist, resources should be allocated and techniques employed to reduce the environmental impact of the incident, eg to contain or divert firewater, blocking of drainage systems or, where appropriate, using firefighting foam as an alternative to water. If foam is used efforts should still be made to contain run-off.

Where defensive firefighting techniques are required account should be taken of the short- and long-term environmental impacts on air, land and water quality so that the least environmentally damaging option is selected. This might be a controlled burn strategy.

Table 3.2 highlights the key stages in determining this relationship.

Table 3.2 Controlled burn considerations

Controlled burn inappropriate	Controlled burn considered
Life/health is at immediate risk or a controlled burn will increase the risk to people	Life/health is not at risk or a controlled burn will reduce the risk to people
There is a high success forecast for extinguishing the fire with minimal impact on human health and/or the environment	There is a low success forecast of extinguishing the fire
There is a high probability of the fire spreading extensively or to high hazard areas	Fighting the fire with other techniques would pose a significant risk to firefighters
Important buildings are involved	Property is beyond salvage
Fire conditions, meteorological conditions and/or local topography are inappropriate, eg plume grounding in populated areas	Fire conditions, meteorological conditions and/or local topography are appropriate for minimising air quality impacts or that to the population
Drainage from the site leads to an area of low environmental sensitivity or firewater is not polluting	Firewater run-off would damage an area of high environmental sensitivity
Firewater can be contained on site, eg firewater ponds or off site, eg local sewage treatment work	Firewater run-off would affect drinking water and other abstractions and/or impair the operation of a sewage treatment works

3.6.3 The legal consequence of allowing fires to burn

The UK FRS legislation does not provide a duty for Incident Commanders or crews to extinguish fires. Therefore a decision on how to conduct firefighting operations would be governed by the general principles in common law relating to reasonableness and foreseeability. In practice this means there are a number of circumstances where the Incident Commander could reasonably foresee the need to cease or limit firefighting operations because the consequences of continuing (whether they be environmental or some other) would be worse than the destruction of property.

For Scotland, the Fire (Scotland) Act 2005, defines 'extinguishing' in relation to a fire to include 'containing and controlling', providing Incident Commanders in Scotland with an option in law of using a controlled burn strategy.

3.6.4 The importance of the building

Certain buildings have a particularly high value, not just in rebuilding costs but also because of their architectural, cultural, historical or strategic significance. Although it is unlikely that a building of this type would be used to store significant quantities of hazardous or polluting substances, where they do, the health and environmental benefits of a controlled burn must be weighed against the value of the building. It is likely any such decision will need to be taken on a case-by-case basis, with advice sought at planning stage from the appropriate conservation body, eg English Heritage. In cases where the building is considered to be of high value and poses a high risk to the environment, then other measures such as firewater containment must be employed during firefighting operations.

3.6.5 In the event of fire

Although controlled burn should ideally be formulated at the planning stage, the strategy chosen will depend on the circumstances that the Incident Commander is faced with on arrival. The decision to allow a controlled burn or not will therefore always rest with Incident Commanders, guided wherever possible by the advice of HMEPOs, environment agencies and other stakeholders.

3.6.6 Communicating the decision

The decision to employ a controlled burn should be communicated by the Incident Commander to the site operator, if present, and to the environment agency, local environmental health departments and, in appropriate cases, the public via the media (see Appendix 5: The Sandoz Fire, Basel, Switzerland).

3.7 Firefighting foam

The fact that firefighting foams can damage the water environment is now broadly understood by product formulators, suppliers and main users such as the petrochemical, aviation industries and FRSs. This should not deter Incident Commanders from using foam at incidents where there is a justifiable need as the operational and environmental advantage can sometimes be substantial (eg compared with water use) (see Figure 3.29).

This section will explore current understanding of firefighting foams as a pollutant and provide guidance on:

- The operational use of foam where protection of the water environment and/or sewage treatment works is an issue
- The provision and use of foam training facilities.

Figure 3.29

Firefighting foam use can be an essential element of an operational strategy. The above photograph shows the resulting run-off from an jet aircraft crash. Speedy intervention with drain blockers and soil prevented a serious pollution incident on this occasion.

Photo credit – Oxfordshire Fire and Rescue Service

Firefighting foam for class B fires typically comprises a blend of hydrocarbon and fluorinated surfactants (detergents) with or without soluble protein. These combinations give rise to fluoroprotein (FP) or film-forming fluoroprotein (FFFP) and aqueous film-forming foams (AFFF). Further ingredients are variously added to reduce fuel pick-up, stabilise the bubble structure, increase shelf life, depress the freezing point and give 'alcohol resistance' for dealing with polar solvent fires (eg alcohol, acetone).

Class A additives normally comprise only a blend of hydrocarbon surfactants but do not contain any fluorinated surfactants because they are not designed to form film. Whilst still often called 'foams', these products are normally used at such low concentrations that a foam blanket is not produced.

There are a number of environmental concerns associated with firefighting foams:

3.7.1 Biochemical oxygen demand

All foam concentrates (for Class A and B use) have extremely high BOD. A typical foam, even when diluted to 3–6% solution for use, will still have a BOD of 50–100 times the strength of untreated sewage. This will lead to deoxygenation of any receiving water body (see Section 1.2.2).

3.7.2 Toxicity

GENERAL

As well as having a high BOD, the surfactants and the other components are acutely toxic to aquatic life in varying degrees. This toxicity is usually but not always of lesser environmental significance than the BOD.

A particular problem with protein-based foams is their potential to break down into ammonia, which is toxic to aquatic life.

FLUOROSURFACTANTS

The ingredients which give film-forming properties are commonly referred to as 'fluorosurfactants'.

PERFLUORO-OCTANYL SULPHONATE

One particular chemical from this group, perfluoro-octanyl sulphonate (PFOS), which was added to 3M Lightwater™ and ATC™ ranges of AFFF products, is of particular concern due to its extreme persistence in the environment. PFOS is also bioaccumulative and has toxic properties. Due to these concerns 3M ceased manufacture and use of PFOS in firefighting foam in 2003.

A European Directive[2] now restricts the marketing and use of PFOS-based foams.

The practical effects of these developments are:

- Foams based on PFOS chemistry are no longer available from manufacturers
- An EU Directive now restricts the marketing and use of PFOS-based foams
- An exemption from the Directive allows PFOS-based foams that were placed on the market before 27 December 2006 to be used until 27 June 2011
- The UK will enact legislation to bring into force the EU Directive. The enforcing body for this legislation is likely to be the environment agencies
- Under current EU and domestic UK legislation there is an absolute prohibition on the discharge of fluorosurfactant-containing foams into groundwater
- The environment agencies have promoted a voluntary ban on the use of PFOS-containing foams and this is the subject of FRS Circular 40/2006.

OTHER FOAMS

Film-forming foams currently on the market contain non-PFOS-based fluorosurfactants. The environmental effects of these fluorosurfactants are currently being studied by manufacturers. The outcome of this research may or may not lead to similar controls being sought as those for PFOS-containing foams.

2 Directive 2006/122/EC of the European Parliament and of the Council of 12 December 2006 amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparatons (perfluorooctane sulfonates).

Due to the high BOD and potential toxicity issues, every effort should be made to prevent firefighting foam entering surface and groundwater during emergency incidents and particularly during testing or training activities.

3.7.3 Sewage treatment

Discharging firefighting foam or firewater containing foam to a sewage treatment works during an incident can be a viable disposal option. However, suitability of this disposal route will depend on the capacity of the drainage system, the size of the sewage treatment works, the type and volume of foam and the presence of any other pollutants within the firewater or foam solution. Before discharge, approval must be sought from the local sewerage undertaker as the introduction of foam into a treatment facility may disrupt the biological process and allow untreated sewage and foam into the receiving watercourse (see Section 1.6.3). The presence of significant amounts of detergent in the incoming flow will also present physical difficulties to treatment works due to excessive foaming, especially where pumping is necessary.

Note
For the effects of firefighting foam on oil separators see Section 1.6.5.

3.7.4 The future and procurement

Various foam formulators are developing fluorosurfactant-free products. These typically have similar BODs to other products but no longer-term environmental concerns have yet been associated with them. FRSs are encouraged to consider the use of these products where they can satisfy themselves that the fire performance meets their needs.

FRSs may also wish to discuss the environmental properties of firefighting foams with manufacturers and their local environment agency representatives.

3.7.5 Compressed air foam systems

Compressed air foam systems (CAFS) were originally developed for Class A applications. They typically use much lower percentages of foam in water, eg 0.1–0.5% of a Class A additive for Class A applications and 0.5–1% of a suitable Class B product for Class B applications. Used properly such systems should reduce water usage and may help reduce pollution due to the lower quantities of foam concentrate used. FRSs may wish to consider the use of these systems where they can satisfy themselves that the fire performance meets their needs with regard to the size and type of fire. They do not, however, eliminate pollution completely as the concentrates are still toxic and possess a high BOD. Environment agency protocols associated with the use of standard firefighting foams must be adhered to for CAFS systems if compliance with water pollution legislation is to be ensured (see Sections 1.4, Environmental legislation and Appendix 3, Protocols) (see Figure 3.35).

Figure 3.30

CAFS in use at a refuse lorry fire. Note the run-off from the foam application. Such run-off will be toxic and have a high BOD if it enters the water environment. Protocols for notification and mitigation should be implemented at CAFS and other foam use incidents.

3.7.6 Use of firefighting foams – environmental considerations

Given the environmental concerns, Incident Commanders must consider the environmental and possible human impacts (via drinking water abstraction) of foam use when evaluating:

- the need for foam use versus any viable alternative, eg water fog
- the use of a 'controlled burn'
- the minimum quantities of foam required to extinguish the fire or maintain a foam blanket to suppress vapours
- the appropriate foam and concentration for the particular application (eg hydrocarbon versus polar solvent fire)
- the necessity of preventing foam run-off entering drains including during make-up activity following extinguishment
- the need to work with local environment agencies and sewerage undertakers to ensure effective containment and treatment of run-off.

For these reasons the use of foam, including that from CAFS systems is a trigger for notifying environment agencies of an incident, as detailed in Appendix 3.

General advice on the procurement, provision and operational use of firefighting foam can be found in *Fire Service Manual Volume 1 Fire Service Technology, Equipment and Media Firefighting Foam – Technical and Fire Service Manual* and *Volume 2 Fire Service Operations – Firefighting Foam*.

3.7.7 Foam training

Foam used during training events must not be allowed to cause pollution as no defence exists under pollution control legislation (see Section 1.4). Both the foam type to be used and the design of the training facility drainage system need to be considered to ensure environmental good practice (see Figure 3.31). Foam training on open land (unmade ground) may lead to ground or surface water pollution and should be prohibited unless agreed with environment agencies.

It is recommended that purpose-made training foams are used for Class B fire training as they usually have lower BODs and do not contain fluorosurfactants. However, as training foams are classified as pollutants, run-off from training exercises must not be allowed to enter surface or groundwaters. Some training foams are specifically designed to mimic operational products having similar physical properties.

FRSs should therefore assess the suitability of each fire station or training establishment as a foam training site. The training area must have an impervious surface to contain and collect the run-off to a common point. If the ground surface is concrete, the expansion joints must all be fully sealed and care should be taken to ensure no other surfaces drain into the area so as to minimise the amounts of rainwater run-off.

Figure 3.31

Photo credit – Oxfordshire Fire and Rescue Service

Only approved training grounds should be used for firefighting foam training. An environmental risk assessment should be undertaken to ensure that pollution of surface or groundwater does not occur.

Some fire training grounds have an oil separator or interceptor incorporated into the drainage system. These devices will not separate out foam products (see Section 1.6.5). Additionally, since foam is a blend of detergents, it will tend to emulsify oil already retained in the oil separator and allow it to discharge. Firefighting foam run-off should not therefore be allowed to enter an oil separator.

At a training venue (on FRS premises or not) the following options exist:

- Discharge to a blind (no outlet) tank with the contents being removed as necessary by a registered waste carrier
- Connection to the foul sewer for treatment at the local sewage treatment works, having obtained the written permission of the sewerage undertaker who may impose conditions (see Figure 3.32 A and B).

To provide full treatment on site and discharge direct to a watercourse. This option, although expensive initially, may be suitable for larger training establishments.

The costs of using registered waste carriers will rise over time and this needs consideration at the design stage.

Notes

1 FRSs engaged in commercial fire training activities should consider the legality of discharging foam extinguishers where the run-off may enter the surface, groundwater sewerage systems or oil separators.

2 To ensure operational effectiveness and to reduce any unnecessary environmental impact, firefighting foam equipment requires regular calibration. This will ensure the correct percentage of foam concentrate is used. Calibration should also take place if an FRS changes its foam equipment or concentrate type. Specifically calibrated foam training equipment may be required for training foams.

Figure 3.32

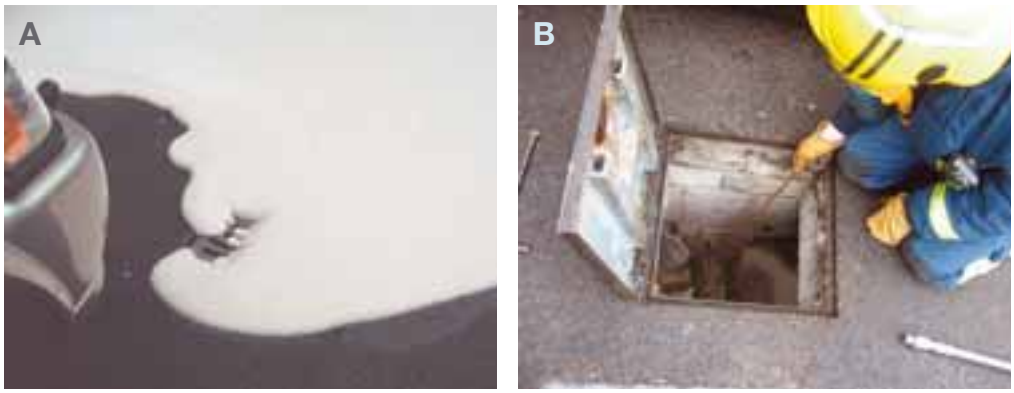


Photo credit – Oxfordshire Fire and Rescue Service

These photographs show firefighting foam entering a drain at a fire station. For the drill session, a diverter valve has been operated to route the foam to foul sewer. Permission of the sewerage undertaker has been obtained.

3.8 Hazardous waste

At emergency incidents hazardous waste (also special waste), as defined by the Hazardous Waste Regulations 2004 in England and Wales, the Special Waste Amendment (Scotland) Regulations 2004 and the Hazardous Waste Regulations (Northern Ireland) 2005, is on occasions produced.

Production of hazardous waste can be as a result of spillage or leakage of products involved in the incident or produced as a consequence of FRS intervention (see Figure 3.33). Products involved that could be classified as hazardous waste might be UN-listed chemicals; oils; fuels; paints; dyes; fly-tipped materials; used pollution control equipment; contaminated protective clothing or other equipment; contained firefighting run-off water or contained/absorbed materials.

Hazardous waste needs to be treated carefully and within the requirements of the various Regulations if injury to firefighters or other people and damage to the environment is to be avoided. Examples of incidents where such waste is produced and that require strict control are detailed in Table 3.3. This table is not exhaustive and where doubt exits, the appropriate environment agency should be consulted.

Figure 3.33

Contaminated oil absorbent materials such as those found in a grab pack may be classed as hazardous waste. Suitably marked bags or containers should ideally be handed over to a responsible person at the scene.

Table 3.3 Examples of incidents producing hazardous waste

Example of incident	Waste produced
Road traffic collisions	Oils, fuel coolant or other liquids
Spillages of non-hazmats	Paints, dyes, inks, etc
Spillages of hazmats	Corrosive, toxic, flammable, etc materials
First aid equipment used	Clinical waste (see Note 1) disposable gloves, pads, bandages etc
Fires involving environmentally damaging materials	Contaminated firewater run-off
Pollution incidents	Contaminated personal protective equipment and other operational equipment

Notes

1 Clinical waste arises out of healthcare treatment. First aid waste will not normally be treated as clinical, unless there is a risk of infection. Clinical waste may be hazardous if it poses a particular risk of being infectious, eg contaminated needles, and requires separate controls. If any doubt exists advice from ambulance service personnel should be sought. Local working arrangements with ambulance trusts can also provide suitable disposal arrangements.

2 Organic materials such as foodstuffs, sewage and farm slurries (even if polluting) and inorganic materials such as cement, sand, etc are not covered by the Regulations on hazardous waste unless contaminated by other hazardous materials, eg sand used to mop up a fuel spillage. However, like any waste, including domestic waste, this has to be dealt with by a registered waste carrier, eg the local authority or private waste contractor.

3.8.1 The role of the FRS at incidents where hazardous wastes are produced or involved

The FRS will normally have no direct responsibility for the disposal of hazardous wastes which are involved or produced at incidents they attend. The definition of 'hazardous waste' can be complex as it can involve calculations of quantities and concentrations in relation to the nature of the product. However, certain wastes will always be classified by the Regulations, such as oils, acids and solvents. Consequently, FRS personnel should treat any potentially hazardous material as hazardous waste until they have been informed otherwise by environment agencies.

Where hazardous waste has been produced at incidents, a duty of care is provided to the FRS Incident Commander. The duty is to ensure that the waste is contained and handed over to a responsible or competent person. It is therefore recommended that the protocols below are adhered to.

Once the Incident Commander is aware that hazardous waste is involved, attempts should be made to identify who has responsibility for its safe disposal. This will vary depending on the exact location of the materials but will usually be as shown in Table 3.4.

The notification to environment agencies of the 'producer' of the waste is legally required by the Regulations.

The 'producer' will normally be the person whose activities have caused it to be produced or the person or organisation on whose land the event has occurred – the polluter.

In cases where there is a risk of pollution and/or threat to public health and the responsible party is not identifiable, or unwilling to act, or the timescale of their response is unacceptable, environment agencies will either advise incident commanders of the necessary action or arrange for the safe and legal removal of the waste themselves using a registered waste carrier.

This will be in accordance with current protocols or Memorandum of Understanding between local government and the environment agencies. On these occasions the environment agencies will, wherever possible, seek to recover their costs from the responsible parties in accordance with the 'polluter pays' principle.

The responsible person should be informed either by the Incident Commander, or preferably by the environment agency officer if present, of their responsibility to organise the removal of the waste using a registered waste carrier. If the responsible party does not have their own arrangements in place to obtain such a contractor, lists of suitable registered waste carriers can be obtained either from Chemdata (companies/waste) or similar database or from environment agencies. It is recommended that FRSs avoid instructing waste carriers themselves to attend

Table 3.4 Basic guide to responsibilities

Local authority
Responsible for materials on playing fields, public open spaces, beaches, etc

Landowner or occupier
Responsible for materials on own private land or inside premises

Highways Agency (Road Service in NI) or their representatives
Responsible for materials on motorways and major trunk roads

County, metropolitan, or unitary authorities
Responsible for materials on roads not covered by the Highways Agency

incidents, as this may result in costs being incurred by fire authorities. Given the potential complexities of this issue it is recommended that FRSs develop local procedures for dealing with waste with the relevant organisations and authorities. Local environment agency staff may attend such meetings on request and offer guidance as appropriate.

In cases where the FRS produces its own hazardous waste at FRS premises, for instance following a fuel spillage at a fire station, the FRS, as does any waste producer, has a legal duty to ensure that the waste is transported and disposed of by a registered waste carrier. In these cases responsibility for employing a suitable registered waste carrier will rest with the FRS.

3.8.2 The role of environment agencies at emergency incidents where hazardous waste is produced or involved

An environment agency's role in waste management is regulatory and it has no responsibility to dispose of contaminated materials at any incident.

Consequently the environment agencies will normally only provide advice to those with responsibility for removing the waste at emergency incidents and, if necessary, Incident Commanders and HMEPOs.

Advice will normally be provided by telephone unless the environment agency is already in attendance because of the potential impact of the incident or it has been specifically requested to attend the incident scene by an Incident Commander.

The only exception to this approach, when the environment agencies may take direct action to remove the waste, will be in the cases outlined in Section 3.8.1 namely, where the waste poses an immediate threat to the public and/or environment.

As well as ensuring correct disposal of the waste, environmental agencies will also take responsibility for any criminal investigation and consequential enforcement action if criminal or illegal activity involving waste is suspected.

3.8.3 The movement of hazardous waste by the fire and rescue service in emergencies

The transport of hazardous waste by FRSs is not encouraged, as environment agencies prefer that such waste is stored securely at the incident scene pending collection by a registered waste carrier. However it is recognised that at some incidents (these are expected to be the exception rather than the rule) the Incident Commander might decide that there is an unacceptable risk to the public or environment from that waste which necessitates its immediate removal to an alternative secure temporary site.

Waste legislation allows the FRS to take temporary responsibility for waste in such situations, providing that the waste can be moved safely without further endangering the public and the environment. Preferably it should be transferred to a secure waste management facility, which can be advised of by the environment agency officer. If this is not possible, the nearest location where the waste can be securely stored pending its collection (as soon as reasonably practicable) should be identified.

The decision to move the waste should wherever possible be taken in consultation with an environment agency officer at the incident scene or by telephone, as this will allow a suitable temporary storage location to be identified and ensure that any other legislative requirements are complied with. Local protocols for notification should be agreed between the environment agency and the local FRS.

Providing the movement of hazardous waste by an FRS is a rare occurrence, as the waste is not being moved in the course of any business or with a view to profit, an FRS will not need to register as a waste carrier. This position may need to be reviewed, however, if such movements take place on a more regular basis or an FRS decides to charge for such a service. FRSs that expect to move waste should ensure that appropriate stowage arrangements, risk assessments and safe systems of work are all in place. Where an FRS has decided not to move hazardous waste in any circumstances, a duty of care still exists and appropriate procedures will need to be implemented to ensure the public and environment are protected. Consequently, protocols with local authorities or other organisations should be considered to ensure that the waste does not injure people or damage the environment should it be left unattended.

3.8.4 The movement and storage of non-hazardous waste

Waste legislation does allow the FRS to transport to fire stations and store pending disposal small quantities of non-hazardous waste such as disposable gloves or limited-life chemical protection suits used by the service at incidents. The criteria to be met are that the waste must be non-liquid and non-hazardous, it is stored in a secure container or containers to a maximum of 50 cubic metres at any time, and for a maximum period of three months. Where possible, Incident Commanders should leave contaminated items with the responsible persons at the incident scene and clean-up responsibility with the relevant competent authority.

Chapter 4

Environmental management

4.1 Notification and recording of pollution control equipment used and fire and rescue service activities at operational incidents

To ensure the continuing success and development of the partnership it is important that the effectiveness of FRS pollution control activity is regularly reviewed and the benefits promoted. It is also important that the costs of pollution control equipment, whether provided by environment agencies or FRSs, are recovered from the polluter, unless there are overriding circumstances. These aims can only be achieved by systematic and accurate recording and reporting of operational environmental protection activities.

FRSs should ensure that attending crews complete a reporting and recording form on every occasion they undertake pollution control activity. An example (RR1) which may be modified to meet local needs is included in Appendix 6.

Activities that should be recorded on the form include: time spent specifically on pollution control activity, the quantities of product contained and pollution techniques, materials and equipment utilised. The activities recorded include improvised activities such as the construction of an earth bund around a drain.

Once completed a copy of the RR1 form should be faxed or emailed to the locally nominated environment agency contact as soon as possible. In England and Wales this must be within 21 days to allow the Environment Agency to generate an invoice within the timescales set out in its incident recharging procedures.

As well as providing the information environment agencies require for recharging purposes, submission of the RR1 will provide a clear audit trail for the equipment they provide the FRS (not in Scotland). It will also provide both parties with a record of the effectiveness of the FRS response and any pollution equipment used.

FRSs should also maintain a record of RR1 forms, as this will allow them to record, report and monitor pollution control activity they undertake. It will also provide valuable data for planning and resource provision purposes as part of an IRMP or equivalent process.

As well as assisting operational staff, the information from RR1s may prove useful to FRS strategic management teams, fire authorities, environment agency planners and central government departments to allow informed decisions concerning resource allocation, and location as part of strategic as well as local planning processes. Additionally, the form can assist in identifying areas of training need.

4.1.1 Equipment re-ordering

Except in Scotland, submission of the RR1 form can be used as the starting point for the equipment re-ordering process, subject to local agreement.

If this approach is agreed, receipt of the form by an environment agency officer will initiate a check on agreed FRS stock levels and when necessary the re-ordering of the equipment used by environment agency staff.

Alternatively the re-ordering of equipment can be carried out as a separate process initiated by an FRS submitting a form setting out the items and amount of equipment/material they require to an agreed environment agency contact. The forms will be supplied by the environment agency and contain a list of the equipment and material they currently provide (see Section 3.2.2). A new form will be supplied to nominated FRS signatories should the list of equipment be modified.

4.1.2 Equipment levels

To ensure continuity of supply it is recommended that a stock of pollution control equipment is held as a non-mobile resource. FRSs should seek agreements locally with their environment agency offices on appropriate stock levels and locations. It is advised that a 100% reserve of non-reusable equipment is held at each station with an additional 50% of the FRS total held at one or more locations. The FRS stock can also be used to replenish individual stations as necessary.

4.2 Environmental management systems

An environmental management system (EMS) provides a structured and documented approach to managing an organisation's environmental performance and responsibilities. The introduction of an EMS into any organisation will contribute to its ability to operate in a sustainable manner, providing benefits to the environment locally and globally. There may also be financial benefits. For a FRS these are most likely to be cost savings gained from improved performance or efficiency. Societal benefits such as a greener reputation within the community are particularly beneficial to public sector organisations.

To be defined as an EMS the system should have certain elements in place and these are outlined in the international standard ISO 14001 or the European Eco-Management and Audit Scheme (EMAS). FRSs can choose to be certified to the ISO standard or registered with EMAS and can demonstrate that they have met the requirements using either internal (in-house) mechanisms or external certification companies.

4.2.1 Steps to implement an EMS

FRSs who choose to implement an EMS that fulfils the requirements of ISO 14001 or EMAS will have to follow a number of steps towards compliance. FRSs will have to:

- Obtain senior management commitment to an environmental policy, which must contain a commitment to:
  - Continual improvement
  - Prevention of pollution (including at operational incidents)
  - Compliance with environmental legislation
- Establish and maintain an up-to-date list of environmental legal and 'stakeholder' (eg local authority policies) requirements
- Identify and evaluate the organisation's environmental aspects (hazards)
- Formulate environmental objectives and targets for the organisation using the environmental policy, legal requirements and environmental aspects
- Make a plan that outlines how the objectives and targets are to be achieved
- Implement the plan by developing capabilities and support mechanisms necessary to achieve the objectives and reaching targets. This includes responsibilities, competencies and resources
- Measuring and evaluating outcomes by using internal and external auditors
- Reviewing and continually improving the plan, procedures, targets and objectives.

This is not an exhaustive account of the ISO 14001 or EMAS requirements and is only intended to provide a flavour of the issues involved. Figure 4.1 provides a diagrammatical representation of the ISO 14001 system.

Figure 4.1

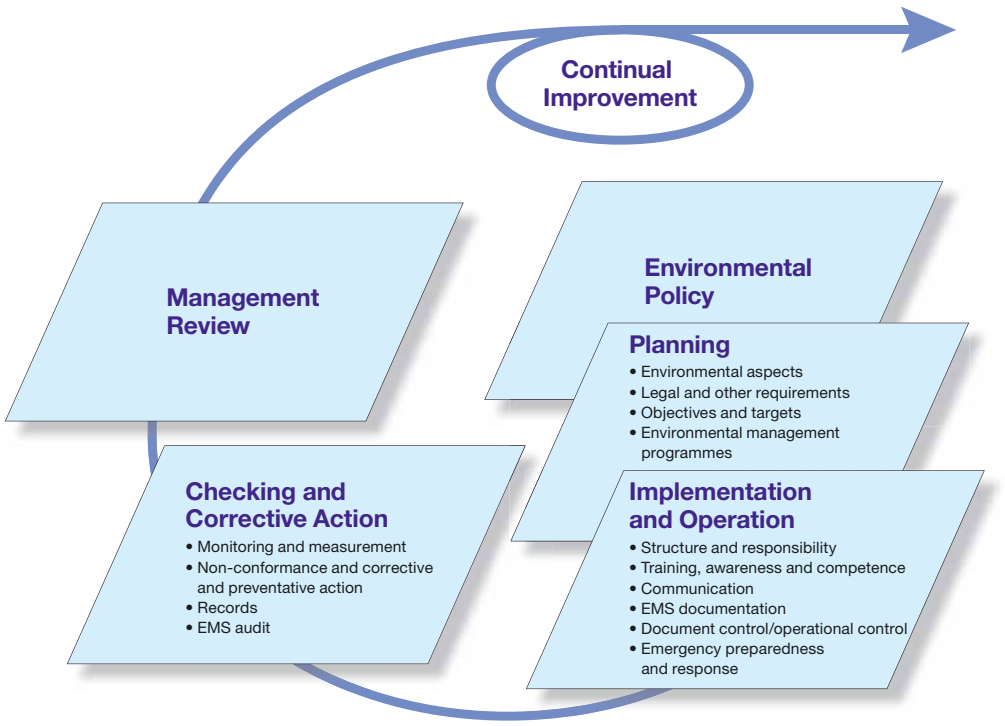


Diagram illustrating the ISO 14001 system.

4.2.2 External certification

There are many companies in the UK that certify organisations to ISO 14001 or EMAS. Some of these are accredited by the UK Accreditation Service (UKAS). FRSs seeking accreditation to ISO or EMAS are advised to use UKAS-accredited certifying bodies. A list of companies accredited to certify EMSs can be found on the UKAS website (www.ukas.com).

4.2.3 Differences between ISO 14001 and EMAS

The two registration schemes offer a different depth of performance management. ISO 14001 is the management element of EMAS and can stand alone, whereas registration under EMAS requires an ISO 14001-based management system as well as additional elements such as an environmental statement, which is verified by a suitably competent person.

4.2.4 EMS and the law

EMSs are not currently part of UK environmental law or a requirement of any pollution prevention regulation. However, having an EMS is recommended in pollution prevention guidance produced by environment agencies as they consider them good practice for all organisations.

4.2.5 Further information

There are many websites that provide information about ISO 14001, EMAS and EMSs. The following may be helpful to FRSs that are considering adopting an EMS.

- British Standards Institution ISO 14001 information pages website (www.bsi-global.com) which includes a new standard BS 8555 for small and medium sized enterprises. The standard takes the form of guidance towards achieving ISO 14001 or EMAS. It is not a certifiable specification itself but outlines an implementation process that can be undertaken in up to six separate phases (each certifiable) towards full EMS implementation
- Environment Agency website (www.environment-agency.gov.uk); look for 'Environmental management systems'
- Institute of Environmental Management and Assessment (IEMA) website (www.iema.net), which provides information about BS 8555 for phased implementation of ISO 14001
- DEFRA guidance on EMAS (www.defra.gov.uk)
- Envirowise website (www.envirowise.gov.uk), a Government-sponsored advice service, which has published a range of EMS-related guidance material and case studies. Envirowise publications are available free of charge; details are on the website.

4.3 The Environmental Information Regulations 2004

Provision was made for the Environmental Information Regulations 2004 (EIR 2004) in the Freedom of Information Act 2000. The Regulations require public authorities to ensure public access to **any environmental information that they hold** in any form (written, visual, aural, electronic). There is no requirement within the Regulations to collect additional environmental information, although this would be good practice within any environmental management system, eg ISO 14001. Requests for environmental information from members of the public or other organisations need not be in writing and must be acted on.

The EIR 2004 require public and some private organisations to take reasonable steps to organise environmental information relevant to the organisation's functions with a view to its active and systematic dissemination to the public. There is also a requirement to progressively make environmental information held – for example, pollution control equipment used at incidents – available to the public by easily accessible electronic means. FRSs may wish to collect such information from similar organisations to allow benchmarking of environmental performance.

The proactive dissemination provision does not apply to information that was previously collected in non-electronic form before January 2005 or to information organisations are entitled to refuse to disclose under the EIR 2004.

If requested, information must be provided as soon as possible and within 20 working days of receipt of the request. If the information request is very complex the deadline can be extended to 40 working days. Organisations can charge for provision of information, but must publish a schedule of charges and information on the circumstances in which a charge may be made or waived.

Defra (Department of Environment, Food and Rural Affairs) guidance advises that: 'In order to demonstrate that the public authority is taking reasonable steps to organise and actively disseminate its environmental information, it is advised to draw up a plan, setting out the steps it proposes to take in order to meet these requirements and to make this available to the public, preferably on its public website.'

The type of environmental information that an FRS might provide includes:

- **Information** on energy use and conservation; noise production; waste production; reuse and recycling; emissions from vehicles and buildings including real fire facilities; discharges to air and water and other releases into the environment
- **Measures** (including administrative measures), such as policies, plans, programmes, environmental agreements, eg with environment agencies
- **Activities** affecting or likely to affect the environment, eg from FRS premises and vehicles or operational incidents or training
- **Factors and measures** or activities designed to protect the environment, eg effectiveness of pollution control activities at incidents and training, environmental protection equipment used, etc and ISO 14001 plans
- **Reports** on the implementation of environmental legislation
- **Cost-benefit** and other economic analyses and assumptions.

Note
This list is a summary taken from Defra guidance and is not exhaustive. For further information, please refer to the Defra website www.defra.gov.uk or the Regulations.

4.4 Charging protocols

Pollution prevention activities of the FRS during the emergency stages of an incident may allow the incident to be closed down quickly or provide the environment agencies with time to call in commercial clean-up contractors to manage the clean-up and subsequent restoration of the environment.

However, on the rare occasions where contractors' attendance times are not suited to the needs of the incident or a suitable contractor is not available, the FRS may be able to assist environment agencies over a protracted period.

In such cases and when the emergency phase of the incident is over, the FRS, subject to operational priorities and resources, might agree to a request from an environment agency for assistance and commit resources to environmental protection work.

When doing so the FRS will in effect be working as a contractor to the relevant environment agency and they will therefore meet FRS costs.

In England and Wales this will be subject to terms set out below. In Scotland and Northern Ireland, no such charging protocols exist; consequently, in these countries, the FRS's own policy on charging will apply.

- FRS costs will only be met by the Environment Agency when an agreement between the Environment Agency Site Controller and the FRS Incident Commander about the work required has been made. This agreement can be made verbally at the incident or over the telephone and will normally involve the provision of an order number. Details of the agreement and the officers involved, including time and date, etc must be recorded and signed at the earliest opportunity.
- When the Environment Agency requests the FRS to attend an incident that they would not attend under normal circumstances, FRS costs associated with the incident will be met by the Environment Agency.
- Chargeable activities will conclude when the Environment Agency advises the Incident Commander that no further action is required or the FRS withdraws due to other operational priorities.

It is recognised that it will not always be possible to define clearly which phases of an emergency incident were related solely to environmental protection as distinct from other FRS activities; for example, stopping the release of hazardous liquids, gases, etc. At incidents where this occurs discussions should take place regarding what can or cannot be included on the invoice.

Environment agencies will not meet costs where:

- There is no risk of pollution to the environment
- Those actions are needed to mitigate the impact of any FRS activity; for example, containing firefighting run-off
- The actions are part of FRS statutory responsibilities, eg extraction of casualties, or are encompassed by their duty of care
- The actions are taken on behalf of a site operator without the prior agreement of the Environment Agency, or a site operator (or other responsible party) directly request FRS assistance. In such cases FRSs may raise charges as provided for by relevant FRS legislation. Reference to these statutory instruments should be made in these circumstances
- The equipment being charged for has been supplied by the Environment Agency.

4.4.1 Invoicing procedures

Where identifiable, environment agencies will normally seek recovery of their costs from the polluter (the 'polluter pays' principle). Consequently, the suitability and accuracy of any invoice received from the FRS is important, as is the inclusion of a full breakdown of the costs[3] associated with the incident, including times and labour and equipment employed. The invoice should also include an FRS contact in case of any enquiries.

Invoices must also be sent within 21 days to a locally agreed Environment Agency contact point or address to allow the Environment Agency to generate an invoice within the timescales set out in its incident recharging procedures.

4.4.2 Obligations on FRSs when working as clean-up contractors

If an individual fire authority proposes to undertake contractual clean-up work regularly then a number of obligations and requirements are placed on them; for example, for oil spill work they should be accredited, and if moving waste, then waste regulations will apply. The FRS should seek guidance from its local environment agency office when considering such activities.

4.5 Trade organisations

4.5.1 UK Spill Association

The UK Spill Association (UKSpill) is an independent trade organisation representing the UK Oil Spill industry. It was established in October 2004, and is recognised by all the UK environmental regulators and the Maritime and Coastguard Agency (MCA) as the national trade association for the industry.

UKSpill uses a national website, www.ukspill.org, to provide a national equipment and contractor database that is available to environment agencies and the MCA in the event of a significant oil pollution event. They also maintain a UKSpill Contractors Accreditation Scheme, which is used to set and maintain standards for the industry.

The Association's main aims are to provide leadership in raising standards through accreditation and training, and to become a focal point for the industry by offering an information resource regarding industry skills.

3 It is recommended that the detailed operational and administrative arrangements for such charging and FRS costs, including labour rates and charges for the use and disposal of FRS equipment and materials, should be discussed and agreed at a local level and included within local agreements.

Where it is proposed by an FRS to provide services as an oil or waste clean-up contractor, they should consider becoming accredited to the UKSpill scheme. This will ensure that clean-up work is undertaken within a framework of the correct training, skills, equipment and standards. FRSs undertaking emergency pollution prevention activities need not become accredited.

4.5.2 Environmental Services Association

The Environmental Services Association (ESA) is the UK's trade association for managers of waste. Its aim is to support compliance with European and UK environmental law with regard to waste.

ESA represents the UK's waste management and secondary resources industry. Its members provide essential waste and secondary resources management services to the public and private sectors. ESA members span the full spectrum of operations – collection, treatment, disposal, recovery, recycling and reuse of waste, specialist equipment, manufacturers and environmental consultancies. Advice on safe and legal waste management is available from local ESA members. A comprehensive list of ESA members and their services is available on ESA's website (www.esauk.org).

4.6 Pollution from FRS premises

All FRS-occupied sites have the potential to damage our natural environment. Pollution incidents can result from spillages, accidents, negligence or vandalism.

FRSs could face fines of up to £20,000 for water pollution and £50,000 for waste offences. The responsible person could also be sent to prison for three months for water pollution and one year for waste offences. If a case goes before the Crown Court (High Court in Scotland) there is no limit to the fine and the responsible person could go to prison for two years for water pollution and five years for waste offences.

Even if a case is not taken to court, the cost of repairing the damage to the environment (clean-up cost) has to be met – these costs can be substantial. For example, fish restocking can cost thousands of pounds and cleaning up serious groundwater pollution can cost over a million pounds. Insurance premiums will increase considerably if a claim for pollution clean-up is made. Reputational damage is also a consideration.

Following this guidance not only reduces the chance of causing pollution, but also makes good business sense. Minimising waste, energy use and pollution risk saves money by reducing operating costs. FRSs that have a 'green' image are keeping up with today's social climate.

4.6.1 Waste management

Organisations such as the FRS that produce waste are monitored by environment agencies. Waste represents the loss of valuable resources, presents a risk to the environment if it is not treated carefully and costs money to dispose of. It is usually possible to reduce waste production and to increase reuse and recycling without additional costs, and in many cases achieve cost savings.

4.6.2 Water quality

All discharges to the water environment require prior permission of environment agencies in the form of a discharge consent or authorisation. This is a legal requirement and contains conditions that relate to the quality and quantity of the discharge. Discharges of trade or sewage effluent to the water environment are illegal if made without consent.

4.6.3 Air quality

Emissions to the air can affect people's health, cause odour nuisance and damage the natural and built environment. The environment agencies currently regulate the release of pollutants, including odour, to the air from large or more complex industrial processes and waste management facilities, such as landfill sites. Local authorities are responsible for local air quality management and regulate emissions of pollutants to the air from smaller processes (SEPA in Scotland). FRSs should contact their local authority for advice on whether emissions – for instance, from real fire training facilities – require authorisation.

4.6.4 Noise and light

Noise and light pollution are not covered in this FRS manual, but should be taken into account when the environmental impact of a site is assessed. Advice on noise reduction can be obtained from local authorities and in Scotland from local SEPA offices.

4.6.5 Getting your site right with the *Pollution Prevention Pays* pack

This pack is available from environment agencies and includes a booklet, posters and accompanying video and is designed to encourage organisations to put effective pollution prevention measures into practice. These can be identified by carrying out an environmental review (site audit), which should cover:

- Legal requirements
- Areas of risk
- Resource management

- Waste minimisation
- Community relations.

An environmental review is the first step towards developing an environmental management system (EMS) (see Section 4.2) which provides the framework for an organisation to deal with the immediate and long-term environmental impact of its products, services and processes. The environment agencies and other independent organisations can help.

The environment agency video *Pollution Prevention Pays* identifies good practice measures and ideas for improvements, many of which can be implemented at little or no cost.

4.6.6 Environmental protection – is your site right?

FRSs can make their site right and protect the environment by putting into practice the action points for the activities and areas listed below.

SITE DRAINAGE

A good knowledge of all the drainage systems on the site is **fundamental** to prevent pollution:

- Produce a comprehensive and up-to-date **drainage plan** of the site, which accurately identifies all drains. If there is no in-house expertise to do this a reputable drainage company should be used. Key staff need to be familiar with the plan, which should be readily available
- Check drainage plans before any new building work is carried out to ensure connections are made to the right drainage system. Remember to update the drainage plan to make sure that any alterations, additions or amendments to the drainage system are shown
- Drains should be identified clearly by colour-coding all manhole covers, drainage grills and gullies. Foul water drains should be painted red and surface water drains blue. Combined drainage systems could be colour-coded with a red letter C. Everyone (including service personnel and contractors) should be made aware of the significance of the colour-coding system
- It is important that there are no wrongly connected effluents, especially in areas in which trade effluent is generated, eg vehicle workshops. The following facilities are often overlooked and must be connected to the foul or combined drainage system (see Trade effluent in Section 4.6.7 for further information):
  - Mess rooms
  - Toilets
  - Showers
  - Sinks, dishwashers and washing machines
- Seal all ducted cableways so that they do not create uncontrolled drainage routes

- Remember that only clean uncontaminated water (eg roof water) can be discharged to the surface water system. A leaflet, *Making the Right Connection*, is available from environment agencies (www.environment-agency.gov.uk)
- If site foul drains are connected to a private sewage treatment system, such as a cesspool, septic tank or package plant, make someone responsible for its upkeep. Make sure it is maintained and emptied regularly (you may need a discharge consent, so check with your local environment agency office)
- It may be necessary to provide permanent drainage isolation facilities (such as penstocks, valves or emergency containment systems) on high-risk areas eg foam training or as part of the site's emergency procedures to prevent spillage or run-off polluting the environment. Contact the local environment agency office for further advice about isolating high-risk areas and sites
- To prevent oil pollution, oil separators (or interceptors) should be provided on any surface water drain at risk – particularly fuelling and vehicle parking areas (a discharge consent may be required; the local environment agency office can advise). A pollution prevention guidance note PPG 3 on separators is available; see Section 1.6.5 for further information
- Oil separators:
  - Must be sized according to the area being drained
  - Will not retain soluble oils
  - Must be maintained and regularly emptied to remove trapped oil and silt
  - Will not work if detergents, including firefighting foams, are present.

4.6.7 Pollution facts

An increasing number of pollution incidents are caused each year by vandalism and theft. It is important to keep one step ahead of potential intruders.

Oil is a particularly harmful pollutant. A small amount of oil causes a large problem. Five litres of oil can cover an area of water the size of two football pitches.

Litter is a pollutant too, and must not be allowed to enter a watercourse.

DELIVERIES AND HANDLING

Delivery and handling of material such as oils, chemicals and foodstuffs around a site is always a high-risk activity. Good working practices are essential.

Special care should be taken during delivery, loading, unloading and transfer of all materials, particularly hazardous substances including fuels, as there is a risk of spillage and accidents. It is important to identify these risks so they can be minimised wherever possible. Making someone responsible for supervising deliveries can help avoid spillages and so prevent damage to the environment, save valuable raw materials and avoid potential legal action.

Action points

- Ensure all **loading and unloading** areas are designated, clearly marked and isolated from the surface water drainage system, for example, by using separators or sumps with isolating valves
- Develop and implement procedures for supervising all deliveries
- Minimise the quantity of material stored on-site. Storage containers and pipework must be well designed, 'fit for purpose' and comply with any relevant regulations. Their condition and storage levels must be checked before receiving each delivery to prevent loss of product, for example, by overfilling or tank failure
- Fit appropriately sized drip trays to all delivery pipe inlets and remove any spilt material immediately
- Fit an automatic cut-off valve or alarm to prevent spillages through overfilling. This may be a legal requirement for oil tanks for which the vent pipe cannot be seen from the delivery point
- Pumped dispensing is preferable to gravity draw-off
- Reducing the need for materials to be moved around the site lowers the risk of accidents or spillage. Transfer routes should be identified and kept clear at all times, the potential for environmental damage assessed and risk reduction measures carried out
- Avoid manual handling wherever possible to reduce the risk of human error and accidents
- Have a contingency plan and make sure everyone is aware of what to do in the event of a spillage or other accident. Have a stock of emergency equipment or grab pack – for example, drain covers, absorbent materials and protective clothing – available nearby to mop up small spillages. Ensure that all residues and contaminated materials are disposed of correctly.

STORAGE

Poor storage of oils, chemicals, firefighting foam and other materials represents a major risk to the environment.

The potential for accidental spillage is greatest during deliveries and dispensing, but storage containers such as tanks, intermediate bulk containers (IBCs), drums, bowsers, etc are also a risk. It is essential that they are sited appropriately, and designed and maintained to take into account environmental protection. The use of secondary containment systems such as bunded areas or bunded pallet prevents materials escaping to the environment.

In England above-ground oil storage containers (eg tanks, IBCs, drums and mobile bowsers) greater than 200 litres must comply with the Control of Pollution (Oil Storage) (England) Regulations 2001 (see Pollution Prevention Guidance Note 2, the Environment Agency leaflet on Oil Storage Regulations or NetRegs at www.netregs.co.uk for further details). In Scotland the Water Environment (oil storage) Scotland Regulation 2006. These differ slightly to the English Regulations and details can be found at www.sepa.org.uk/regulations/oilstorage2006/index.

html. Oil storage regulations in Wales and Northern Ireland are expected to set similar standards. FRSs must find out if oil storage legislation applies to their above-ground oil store as some of the action points below may be a legal requirement.

Action points

- Use an appropriate container for the material stored. Make sure it is fit for purpose and clearly labelled with product type, maximum capacity and both health and safety and environment protection information
- Locate storage facilities away from watercourses, open drains, gullies, unsurfaced areas or porous surfaces
- Protect containers from impact damage where necessary
- Roof storage is high-risk and should be avoided because any loss of the contents may drain to the surface water system via guttering and cause pollution
- Storage tanks, IBCs and bowsers for chemicals, oils and raw materials such as firefighting foam must have a secondary containment system able to hold at least 110% of the tank's maximum capacity. It must be impermeable to the material stored, enclose the ancillary equipment (eg local fill and draw-off facilities, vent pipes, sight gauges, taps, valves, etc) and have no drain-down outlets or connection to the environment
- Secondary containment for drum storage should be provided by using a proprietary container store, bunded pallet, drip tray or kerb-bunded area – preferably roofed. The capacity should be at least 25 per cent of the total volume of the drums being stored. Where access for vehicles is necessary provide a properly designed ramp, but make sure use of the ramp does not cause spillages
- Loss from the container beyond the secondary containment system (known as jetting) can be minimised by keeping the container as low as possible, providing deflection screens and directing any potential discharges into the containment system
- Produce maintenance schedules for regular inspection of storage facilities and make sure any necessary remedial work is carried out promptly and recorded
- Regularly remove rainwater which may have collected within open containment systems. This waste water may be contaminated and must be disposed of appropriately in accordance with waste management legislation (see 'Waste management' below). In the long term it may be more cost-effective to roof the facility or even replace the tank with a proprietary enclosed bunded tank system All pipework must be protected against corrosion and physical damage (eg collision, vibration, ground disturbance, etc). Above-ground pipes should be properly supported and their condition checked frequently

- Avoid underground pipework, as faults are very difficult to detect and can lead to groundwater contamination. If they have to be used underground, pipes should preferably be laid in an impermeable duct, must have inspection chambers at all mechanical joints and be tested regularly to ensure they are not leaking. Their route should be marked clearly on the ground and on all site plans
- Provide security measures for the site and storage areas to prevent vandalism and theft. Storage system valves, taps, hatches or lids and delivery hoses should be fitted with locks and locked shut when not in use. Where possible materials should be stored in secure buildings.

UNDERGROUND STORAGE

Underground storage of oils and chemicals is a significant pollution risk to groundwater. The Groundwater Regulations 1998 or equivalent enable the environment agencies to issue pollution prevention notices to make sure precautions are taken to protect groundwater.

Statutory Codes of Practice made under the Groundwater Regulations or in Scotland the Water Environment (Controlled Activities) (Scotland) Regulations 2005 contain specific requirements and advice for the underground storage of oil and chemicals. FRSs must find out if these Regulations apply to their underground storage.

Action points

- Avoid underground storage of oils, etc unless absolutely necessary. Where unavoidable, contact the local environment agency office for further advice
- It is essential that the risk to groundwater is reduced by good leak-detection facilities and management procedures.

WASTE MANAGEMENT

FRSs should minimise waste production to save money and resources. Legal waste storage and disposal is an essential pollution prevention measure.

Waste management and disposal is subject to strict legal controls. FRSs must find out how these regulations affect them. The NetRegs website (www.netregs.co.uk) provides full details of waste legislation and compliance. Contact the local environment agency office for further advice.

WASTE MINIMISATION

A waste minimisation review will help to save money on raw materials and waste disposal costs. For example, work with suppliers and distributors to find ways to eliminate or reduce the amount of packaging. Further advice on waste minimisation and initiatives in an FRS area can be obtained from local environment agency offices. Free independent information on waste minimisation is available from Envirowise and includes publications, events, site visits and specific advice. Visit the Envirowise website at www.envirowise.gov.uk, or call the Environment and Energy Helpline on 0800 585794.

Action points

- Carry out a waste minimisation review and consider methods to reduce the volume of waste produced. Contact the Environment and Energy Helpline for free advice on 0800 585794
- Reuse waste or buy in products that can be reused many times – it will save money in the long term
- Recycle as much waste as possible. Local councils or waste contractors should know about the facilities in their area
- The burning of waste or discarded items for training purposes is in most cases illegal under current waste legislation. FRSs should therefore only source (or purchase) clean uncontaminated combustible material from reputable suppliers. Accepted material is limited to uncontaminated and untreated pallets or timber and paper or straw to start the fire. Unacceptable materials would include contaminated or treated pallets, old furniture or similar, carpets, or any other waste matter
- Try to substitute materials for less hazardous ones, for example, biodegradable lubricants and solvent-free paints
- Have waste taken off-site frequently; do not allow large quantities to accumulate. Under their duty of care, FRSs have a legal duty to ensure that any waste produced does not escape from control, is transferred only to an authorised person (eg registered or exempt waste carrier or authorised waste manager), is accompanied by a full description of the waste and a waste transfer note, and is disposed of lawfully
- Waste must always be stored in appropriately designed containers that are fit for purpose and of sufficient capacity to avoid loss, overflow or spillage
- All waste and waste containers must be stored in designated areas, which are isolated completely from surface water drains or direct discharge to the environment. The area should be able to contain spillages
- Segregate and label both wastes for recycling and hazardous waste from general waste
- Do not mix or dilute hazardous wastes
- Where appropriate skips should be covered or enclosed unless stored undercover or within a building
- Waste compactors can produce highly polluting run-off and must be isolated from surface water drainage systems. It is best to drain the area to the foul sewer, with prior permission of the local sewerage undertaker, and to provide a roof to minimise the discharge
- The disposal of certain hazardous wastes (eg oily wastes, acids, solvents and solvent-based products) for instance, from FRS vehicle workshops, have particular legal requirements and their movement must be accompanied by a consignment note. Copies must be kept by all those parties involved in the transfer of the waste, including the environment agencies. Contact local environment agency offices or visit the NetRegs website (www.netregs.co.uk) for information on whether waste materials need to meet these requirements

- Burning material in the open air is an undesirable method of waste disposal and, in many cases, unlawful. Always try to find another way to dispose of waste that is less harmful to the environment. Contact your local environment agency office for advice or visit the NetRegs website (www.netregs.co.uk).

TRADE EFFLUENT

Liquid effluents that are produced, for instance, from FRS workshops facilities, and foam training run-off are known as 'trade effluents' and require special consideration for their disposal.

Most trade effluents are polluting and must not be discharged to the surface water system. Generally the 'best environmental option' is to discharge trade effluent to the public foul sewerage system with the prior permission of the local sewerage undertaker. There may be conditions set on the quality and quantity of a discharge and pretreatment may be necessary, depending on the nature of the effluent.

If discharge to the public sewerage system is not possible, a private treatment system may be considered which must be designed specifically to treat all effluents connected to it. FRSs will need prior environment agency consent for any treated trade effluent discharge to the environment. It is unlikely that consent would be given to discharge trade effluent to the ground.

If treatment or sewage disposal options are not possible then, because trade effluent is regarded as a liquid waste, storage and off-site disposal will be necessary and waste management legislation will apply.

Action points

- Trade effluent drainage systems should be checked regularly for leaks. All treatment plants, including storage vessels and waste chemical or oil storage areas, must be isolated from surface water drains
- Discharge points for all trade effluent gullies and drains must be checked and included on a site drainage plan
- Some effluents may be a small volume or considered 'clean', but the disposal route of all trade effluents must be considered. Examples of effluent sources on FRS premises could include:
  - Compressor blowdown
  - Cooling water
  - Steam condensates
  - Boiler blowdown
  - Air conditioning
  - Compactor run-off
  - Pressure testing liquids
  - Firefighting foam from training including fire extinguishers.

CLEANING

Vehicles, components, plant and equipment, floors, surfaces and containers are often cleaned on FRS sites. All these activities generate dirty water and the disposal of this effluent, as with all trade effluents, must be considered carefully. All cleaning agents are potential pollutants, as are the materials they are intended to remove. These include detergents (even the biodegradable ones), disinfectants, degreasers, dirt and oil.

Action points

- Carry out all washing and/or cleaning operations in a clearly marked, designated area. This includes cleaning vehicles or plant
- Isolate all cleaning or wash-down areas from the surface water system and unmade ground or porous surfaces by using drainage grids, gullies or kerbs. Wash water should drain or be disposed of only to the foul sewer; check with the local sewerage undertaker before making a disposal to ensure they are aware of this discharge. Ensure all contractors and/or cleaners know where they can dispose of waste waters properly
- Cleaning agents including detergents are not suitable for discharge to surface water drains, even those described as biodegradable. **Do not allow detergents to enter oil separators as the oil will be washed through.** If yard areas are cleaned do not allow the run-off to enter surface water drains
- Think carefully about site drainage before using a mobile steam or pressure cleaner, especially if detergents or degreasers are used. Ensure they are operated only in an area isolated from the surface water system and oil separators. Detailed guidance for the use of steam and pressure cleaners is available in *PPG13* (www.environment-agency.gov.uk).

DEWATERING

Take care when removing excess water from a site, or dewatering generally, especially in areas that may be or are known to be contaminated. It is often necessary to dewater underground ducts or chambers for inspection and maintenance purposes. This results in a relatively small volume of liquid to dispose of. Larger volumes may be produced as a result of groundworks or construction projects in which excavations extend into groundwater sources or collect rainwater and other run-off.

Action points

- Before any dewatering takes place, the collected water should be tested to determine its quality and the most appropriate disposal option. The disposal of polluted water requires careful consideration and must be discussed with the local environment agency office before any discharge is made
- Silty water should never be pumped directly to a river, stream, road or yard gullies or surface water drains, eg in a roadway
- Silt is generally a non-toxic pollutant and, in the absence of any other contaminants, can be disposed of by pumping to a settlement tank or over a large grassed area. If there is **any risk** that the silty water is contaminated with any other pollutant, you should consult with environment agencies before its disposal

- A pollution prevention guidance note (PPG20) that deals specifically with the dewatering of underground ducts or chambers and from construction and demolition sites is available (www.environment-agency.gov.uk).

GROUNDWATER PROTECTION

Groundwater is out of sight, but must not be out of mind. As a valuable resource it must be protected from pollution.

Spillage and unsuitable disposal of oils, solvents, chemicals or waste materials causes serious damage to groundwater. Pollution can occur from discharges onto open ground and other porous surfaces or from drainage systems that soak into the ground (soakaways). Chlorinated solvents (eg trichoroethylene and perchloroethylene) are among the most serious causes of groundwater pollution. A leaflet, *Solvent Pollution and How to Avoid It*, is available from environment agencies. It is vital that groundwater pollution is avoided, as once it has become contaminated, groundwater is difficult and expensive to clean up.

It is essential to find out if the FRS site is in a sensitive groundwater area (eg within the catchment of a drinking water supply borehole) as managers may have to take additional pollution prevention measures to minimise the risk of causing groundwater pollution.

Statutory Codes of Practice made under Groundwater Regulations or equivalent on specific high-risk activities such as the underground storage of fuel, the use of solvents and non-mains drainage, are available from environment agencies.

The environment agencies have powers to require action to be taken on storage, handling, use or disposal of certain dangerous substances (eg hydrocarbons, solvents, biocides, metals and ammonia) that are a potential risk for contaminating groundwater. Groundwater Regulations require authorisation by environment agencies before disposal of waste that contains these substances into or onto land. Advice on this is available from local environment agency offices.

Action points

- Find out if the FRS site is in a sensitive groundwater area; contact your local environment agency office for further information and advice about additional pollution prevention measures
- Consult with the agencies about arrangements for storage and disposal of chemicals or waste
- Only allow clean uncontaminated rainwater to discharge to soakaways
- Never allow wastes or chemicals to be disposed of onto the ground
- Spillage of oils, chemicals or wastes must be dealt with promptly. Any contaminated soil should be removed and disposed of according to emergency plans and waste management procedures. Specialist advice may need to be sought on remedial action for spillages of certain substances.

TRAINING AND EMERGENCY PLANNING

Training plays a crucial role in protecting the environment. Trained and knowledgeable staff can help prevent or lessen the effects of a pollution incident – saving both money and time.

Occasional accidents are inevitable so it is important to have plans in place to deal with pollution emergencies and make sure everyone knows what to do in the event of an incident. **The agencies must be notified of any environmental incident as soon as possible.**

Training should cover environmental awareness, correct procedures and pollution-incident response.

Action points – training

- Make sure everyone is aware of how important it is to protect the environment and what the FRS can do to prevent pollution. Include environmental training for new starters
- Organise screenings of the *Pollution Prevention Pays* video and display the posters available with this pack in positions where everyone can see them
- Reinforce training with a regular refresher programme
- People (and their deputies) who have specific responsibilities for procedures or plant with a potential environmental impact should receive regular and adequate training in their role. They must have an awareness of the potential for harm to personnel and the environment from materials and equipment they are responsible for
- Contractors should be trained in relevant environmental management and emergency procedures before starting work.

Action points – emergencies

- FRSs should develop pollution incident response plans for their own premises to prevent harm to human health and minimise damage to the environment caused by accidents, fires or spillages. Further guidance and a template are available in *Pollution Prevention Guidance Note 21*
- Test incident response plans by carrying out simulations and exercises for all those involved. Amend the plan to account for any deficiencies
- Always have adequate emergency pollution-control equipment available to deal with spillages, accidents or firewater, such as absorbent materials, drain blockers or incident grab packs. Do not forget to provide personal protective clothing. More information on dealing with spillages and firewater is given in *PPG18*
- Make someone personally responsible to regularly check and maintain routine and emergency pollution control and prevention equipment, devices and procedures. Make sure any remedial work is carried out as soon as possible
- Devise procedures for the recovery, handling and disposal of all waste material that arises from incidents or emergencies
- If you have an incident that has or is likely to damage the environment you must inform the appropriate environment agency.

4.6.8 Pollution facts

- Most pollution incidents are the result of ignorance, apathy or neglect of basic procedure.
- Just 250 grams of pesticide could be enough to exceed the permitted limit in the whole of London's water supply for one day.
- Just one litre of solvent is enough to contaminate 100,000,000 litres of drinking water (that is equivalent to approximately 50 Olympic-sized swimming pools).

4.6.9 Further information

The agencies publish a series of free pollution prevention literature. The following are of particular relevance to changes of FRS premises.

POLLUTION PREVENTION GUIDANCE NOTES

PPG2 Above Ground Oil Storage Tanks
PPG3 The Use and Design of Oil Separators in Surface Water Drainage Systems
PPG6 Working at Demolition and Construction Sites
PPG11 Preventing Pollution at Industrial Sites
PPG13 High Pressure Water and Steam Cleaners
PPG18 Managing Firewater and Major Spillages
PPG20 Dewatering of Underground Ducts and Chambers
PPG21 Incident Response Planning
PPG26 Storage and Handling of Drums and Intermediate Bulk Containers
PPG28 Controlled Burn

LEAFLETS/BOOKLETS

Making the Right Connection
Solvent Pollution and How to Avoid It
Oil Storage Regulations
Works Notices Regulations – Information on Anti Pollution Works Regulations 2001
A Guide to Good Environmental Practice for Trading Estates and Business Parks

VIDEO PACKS

Money for Nothing – Waste Tips for Free
(waste minimisation information)
Keeping out of Deep Water – Groundwater Protection for Industry

Many of these publications are available from the environment agencies' websites, together with other relevant information.

NETREGS

Offers clear guidance and explains the regulations that apply, broken down into specific business premises. It also offers advice on good environmental practice and provides links to Business Support and other helpful organisations. It is free, anonymous and is designed to guide businesses through environmental regulation. Contact **www.environmentagency. gov.uk/netregs or www.sepa.org.uk/netregs**.

ENVIROWISE

Offers free, independent practical environmental advice for all businesses; this includes free publications, events, site visits and waste reviews. More information is available from www.envirowise.gov.uk or by calling the Environment and Energy Helpline on 0800 585 794. For a comprehensive introduction to waste minimisation ask for a free copy of *IT 313 Waste Wise – Increased Profits at Your Finger Tips*. This is an interactive CD-ROM that brings together all the essential information organisations need to minimise waste and save money.

ARENA NETWORK

Is an independent organisation that works in partnership with the main Welsh agencies (eg National Assembly for Wales, Welsh Development Agency, Environment Agency Wales) and provides practical support to business and other organisations primarily in Wales on environmental management and training related issues. For more information visit **www.arenanetwork.org**.

DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS (DEFRA) PUBLICATIONS

(Telephone 08459 556000)
Guidance Note for the Control of Pollution (Oil Storage) (England) Regulations 2001 Product code PB5765
Groundwater Protection Code for Petrol Stations and Other Fuel Dispensing Facilities Involving Underground Storage Tank 2001
Groundwater Protection Code for the Use of Solvents

Appendix 1

Local agreement template between [the xxx fire and rescue service] and the environment agency

1 Aim and Purpose

1.1 This local protocol sets out how co-operation on fire and rescue matters between a Fire and Rescue Service, hereby called 'the Service' and the Environment Agency, can implement the principles of shared working agreed and signed by the Local Government Association and the Environment Agency in the shared agreement 'Working Better Together 2003'.

1.2 To achieve this outcome, the Service and the Environment Agency agree to the following local interpretation of those levels of service set out in the Annexes of the Working Better Together on Fire and Rescue Services Protocol.

2 Areas of Mutual Interest

2.1 Emergency Planning and Integrated Risk Management Plans/Risk Reduction Plans

Insert text

2.2 Pollution Incident Management

Insert text

2.3 Training, Exercising and Pollution Prevention

Insert text

2.4 Information Exchange and Contact Arrangements

Insert text

2.5 Flood Risk Management

Insert text

3.0 Review Arrangements

The Environment Agency and the Service [XXXXXX] will support this protocol agreement and work together to develop and implement it.

Signed on behalf of the Environment Agency

Title .....

Date .....

Signed on behalf of the Service [XXXXXX]

.....

Title .....

Date .....

Appendix 2

Terms of reference for FRS and environment agencies liaison groups

The National Environmental Strategy Group (FRS and environment agencies) (NESG)

Terms of reference

The group will:

1 Review and where necessary identify issues requiring update or inclusion within:

- The protocol between the Environment Agency LGA and WLGA on FRS issues
- The MoU between the Scottish FRS and SEPA
- The MoU relating to emergency response to incidents involving environmental damage between the Northern Ireland FRS (NIFRS) and the Northern Ireland Environment Agency.

2 Promote liaison between the environment agencies and FRS at all levels. Make recommendations on how liaison can improve the effectiveness of the organisations involved.

3 Identify good practice within the UK. Make recommendations for implementation and promotion of identified areas, including, where necessary, production of an implementation plan and/or joint research. This work should include consideration of current working practices and key issues identified from incident reviews.

4 Determine future strategy options for the provision of pollution control equipment for FRS use and identify costs. This should include consideration of alternative sources of funding and links with other associated initiatives such as CBRN, where the equipment may have mutual benefits.

5 Provide direction on environment agencies' input into FRS training programmes including courses at the Fire Service College, Moreton-in-Marsh, Scottish FRS College, Gullane, other training courses and training materials such as FRS manuals.

6 Provide direction to the National (FRS and environment agencies) Environmental Operations Group (NEOG).

7 Provide and if necessary seek clarification on the requirements/implications of relevant legislation.

8 Act as the review group for relevant guidance materials, any such review should include the identification of appropriate staff and resources needed to undertake any work required.

Group membership

- Chair, Environment Agency Environment Management Process Manager
- Technical Secretary, Environment Agency Pollution Prevention Technical Advisor
- Environment Agency
- Environment Agency Northern Ireland
- Scottish Environmental Protection Agency
- CFOA (England and Wales)
- Chief Fire and Rescue Advisors Unit
- Scottish Fire and Rescue Advisory Unit
- Fire Service College (HMEP)
- Northern Ireland Fire and Rescue Service.

The Group meets every four months and more regularly if issues dictate.

The National Environmental Operations Group (FRS and environment agencies) (NEOG)

Terms of reference

1 Provide technical support and operational guidance to the NESG.

2 Identify issues requiring updating, amending or for inclusion within the Protocol or MoUs.

3 Identify and promote good operational practice on environmental issues within the UK FRS. Make recommendations for implementation and promotion of identified areas to the NESG. This work should include consideration of current working practices and key issues identified from incident reviews.

4 Coordinate FRS liaison at a local operational level. Promote the development of Local Agreements within a common national framework.

5 Maintain details of the current levels and location of pollution control equipment held by FRSs.

6 Identify future equipment requirements and consequent budgetary needs. Ensure that allocated funds are spent within the current financial year and areas where coverage is inadequate are identified and prioritised so that spending can be targeted, should funds become available (not Scotland).

7 Review the use and effectiveness of pollution equipment held/supplied by the FRS. Coordinate the evaluation of new items of equipment and recommend placement onto the nationally agreed equipment list (not Scotland).

8 Ensure that the agreed procedures for the recovery of costs associated with the use and replacement of equipment provided by the environment agencies, and the services provided by the FRS, are implemented in a consistent manner (not Scotland).

9 Provide input into the environment agencies' FRS Training Strategy including courses at the National FRS College, Moreton-in-Marsh, Scottish FRS College, Gullane, other training courses and training materials such as FRS Manuals.

10 Provide comment on relevant guidance materials.

Group membership

- Chair, Environment Agency Pollution Prevention Technical Advisor
- Technical Secretary, Environment Agency
- Scottish Environmental Protection Agency
- Environment Agency, Northern Ireland
- Environment Agency – Wales
- Environment Agency – North-East Region
- Environment Agency – South-West Region
- Environment Agency – Anglian Region
- Environment Agency – North-West Region
- Environment Agency – Southern Region
- Environment Agency – Midlands Region
- Environment Agency – Thames Region
- Environment Agency – Procurement
- Fire Service College
- Chief Fire & Rescue Advisers Unit (England & Wales)
- CFOA England & Wales (3)
- Northern Ireland FRS
- Scottish FRS.

The Group meets every three months and more regularly if issues dictate. In Scotland SEPA and the Scottish FRS meet on an annual basis to review the MoU and keep each other informed of new and emerging developments.

Local liaison groups

England and Wales

In England and Wales it has been agreed that each FRS will appoint an environment agency liaison officer. This officer will normally be the nominated lead officer on Hazardous Materials and Environmental Protection (HMEP Officer). Similarly each Environment Agency region will appoint a FRS liaison officer, supported by an appointed FRS liaison officer for each of its areas within that region. Each Environment Agency (England & Wales) region will hold quarterly or six-monthly meetings where representatives from each FRS and appointed liaison officer will meet to discuss local and national issues.

A key purpose of the regional meetings will be to ensure that effective Local Working Arrangements are produced for each FRS, signed and then implemented. Such agreements are actively promoted in the National Protocols/MoUs. The arrangements should deal with day-to-day matters associated with a particular FRS to meet local needs. A template for producing Local Working Arrangements can be found in Appendix 1.

Where one FRS area is served by more than one Environment Agency region, the region forming the larger part of the area will jointly produce, sign and implement the local agreement. Where necessary more than one agreement can be made with two or more regions; however, this should be considered the exception rather than the rule.

Areas for liaison and inclusion in such agreements include:

- Non-standard equipment provision
- Notification and recording of incidents
- Operational incident protocols
- Incident debriefs
- Training of fire service and environment agency personnel
- Operational procedures and safe systems of work
- Risk assessments.

Terms of reference for regional groups

1 Provide support to the NEOG.

2 Identify issues requiring update or inclusion within Local Working Arrangements between FRS and the Environment Agency region(s) within a common national framework.

3 Consider good operational environmental practice within the region and make recommendations for implementation and promotion of identified areas to the NEOG. This should include consideration of current local working practices and key issues identified from local incident reviews.

4 Maintain details of the current levels of pollution control equipment supplied to FRSs and its location within the region. Provide details to the NEOG. Ensure that allocated regional budget is spent.

5 Identify future equipment requirements and consequent budgetary needs within the region. Ensure that areas where specialist equipment coverage is inadequate are identified and passed to the NEOG so that spending can be targeted to highest priorities as funds become available.

6 Continually review the use and effectiveness of pollution equipment supplied to FRSs and evaluate new items or changed requirements as requested by the NEOG.

7 Ensure that the agreed procedures for the recovery of costs associated with the use and replacement of equipment provided by the Environment Agency and the services provided by the FRS are implemented locally. Report to the NEOG as necessary.

8 Provide feedback to the NEOG regarding the Environment Agency's Training Strategy including courses at the National FRS College, Moreton-in-Marsh, other training courses and training materials such as FRS manuals.

9 Provide comment on relevant guidance materials.

Group membership

- Chair, Environment Agency Regional Fire and Service Liaison lead officer
- Technical Secretary Environment Agency
- Environment Agency representative for each FRS
- FRS representative from each FRS.

Scotland

In Scotland there is regular liaison between the CFOA (Scotland) representing the Scottish FRS and SEPA. Regional groups liaison at local level is encouraged within in the Scottish MoU.

Northern Ireland

In Northern Ireland there is regular liaison between the Northern Ireland FRS and the NIEA. Working partnerships have been established between NIFRS Hazmat Officers and regional and headquarters operational staff.

Appendix 3

Operational Incident Plan template – 7.2 (d)

Document Ref: 29/03/07 11:13

62 – Gibson Paints, Albion Works, Trafalgar St, Newton

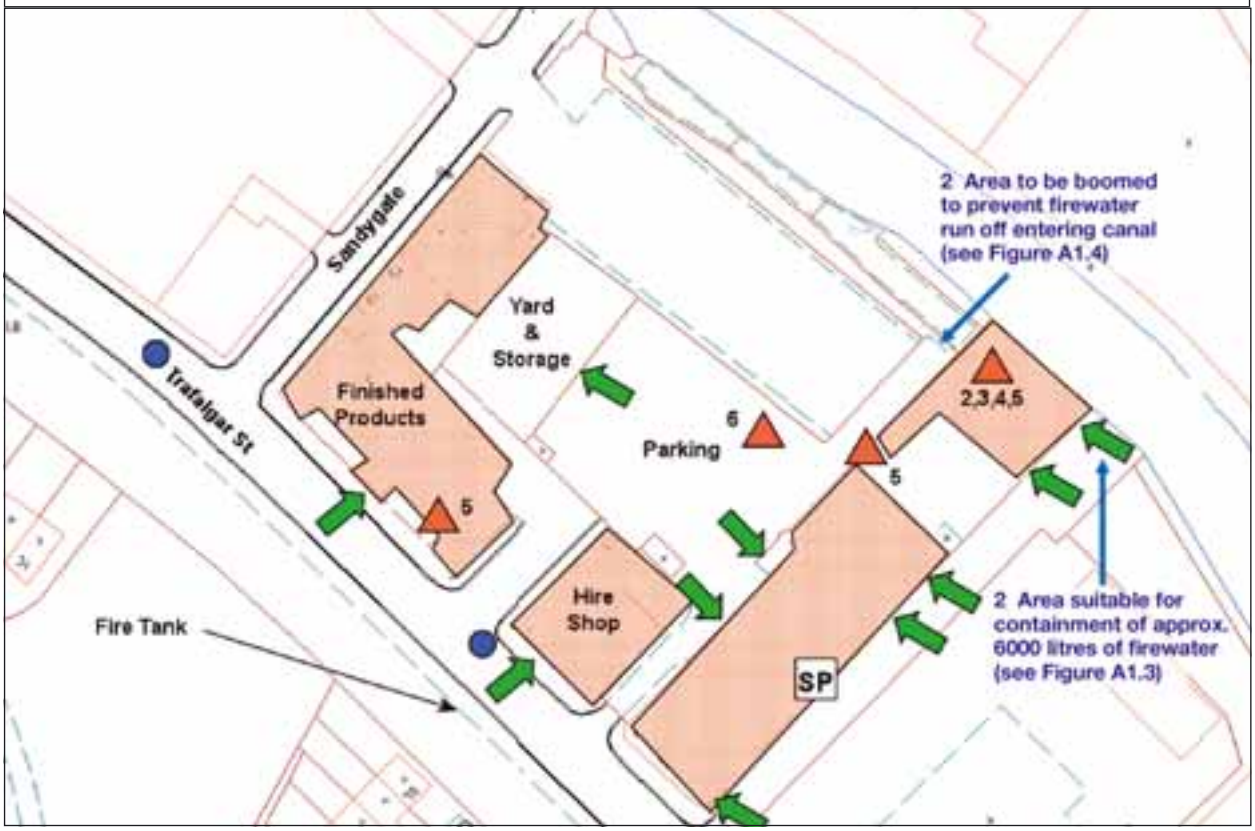
OPERATIONAL INCIDENT PLAN	
Lancashire Fire and Rescue Service Incident Plan – Fire & Rescue Services Act 2004 – 7.2 (d)	Ref No 62007

Name: Gibson Paints Address: Albion Works Trafalgar Street Newton, BB65 4JX FSIS No: M0399 Grid Ref (6 figure): 654786 PDA: 2P	**Informative Message** Use: Paint distribution and biodiesel manufacture Floors: 3 Basement: – N/A Length: 60m Width: 20m

Route from nearest main junction. Grid Ref of junction: 676789
From Jct 18 M68 follow Westway turn right into Trafalgar St. Premises are on left before petrol station.

Action on arrival (O.I.C. 1st Attendance)
• Main entrance to building at front (Trafalgar Street) • Contact Site Manager • Old design and layout of building could possibly lead to rapid fire spread • Large quantities of paint stored in premises • Unlimited water supply from canal off Sandygate

SITE LOCATION PLAN



PRIMARY HAZARD INFORMATION

HAZARD NO.	TYPE & AMOUNT	LOCATION	FURTHER INFORMATION	HAZARD
1	Petroleum mixes and paints	All Floors	Hazchem 3YE	Flammable & Toxic
2	Methylisobutyl ketone	Underground Tank	2500 Litres 3YE FDP 21°C	Flammable Liquid
3	Methyl Ethyl ketone	Underground Tank	4500 Litres, FP –5°C	Flammable Liquid
4	Toluene	Underground Tank	4500 Litres, FP –5°C	Flammable Toxic Liquid
5	Xylene	Underground Tank	4500 Litres, FP –24°C	Flammable Toxic Liquid
6	White Spirit	Ground Floor	5000 Litres	Flammable
7	Biodiesel	Ground Floor	10000 Litres	Combustible at raised temperatures and Toxic
8	Ethanol	Tank adjacent to Biodiesel Plant	Hazchem 2YE 5000 Litres	Flammable Toxic Liquid

ADDITIONAL INFORMATION

- Electric cut off, ground floor works side entrance
- Gas cut off, ground floor works side entrance adjacent to inner yard
- Water cut off, adjacent to gas cut off
- Sprinkler stop valve, main corner entrance works, off Trafalgar Street

ENVIRONMENTAL PROTECTION

- **Sources of pollution on site:**

  Various oils and toxic chemicals and waste solvents = HIGH RISK

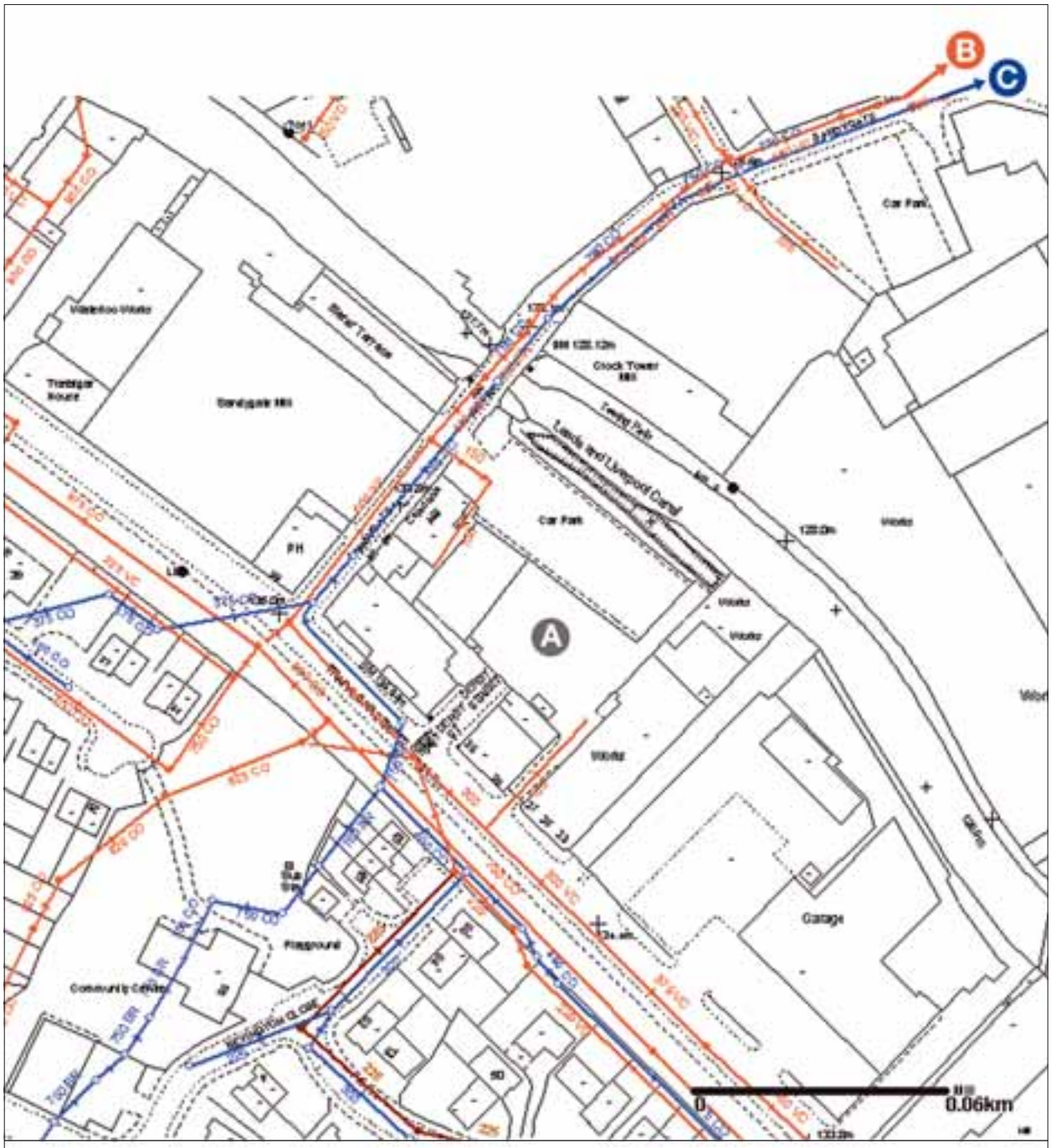
- **Pathways for run-off:**
  - Most run-off direct to Leeds/Liverpool Canal at rear.
  - Surface-water sewer along Trafalgar Street and Sandygate Lane, drains to River Calder under St James's Street.
  - Groundwater – minor aquifer, vulnerability unknown.
  - Foul sewer runs along Trafalgar Street and Sandygate Lane, leads to Newton WwTW.
- **Receptor sensitivity:**
  - River Calder = MEDIUM
  - Leeds/Liverpool Canal = HIGH
  - Groundwater = MEDIUM
  - Newton Waste-Water Treatment Works = LOW

ACTIONS:

- Prevent firewater entering Canal at rear from two Points: Point 1 adjacent to Biodiesel Plant – ensure air valve in drain to canal is CLOSED, use bunded area to contain fire water, (see Plate 1). Point 2 from parking area will require booming to contain firewater (see Plate 2).
- Consider mobilising the Hazardous Materials & Environmental Protection Unit.
- Contain firewater.
- Contact Environment Agency for advice on firewater disposal.
- Firewater may be unsuitable for re-use due to flammable nature of on-site chemicals.
- Divert firewater to sewer only if it does not contain flammable liquids. Contact United Utilities first.
- Do not allow firewater to enter road drains at front on Trafalgar Street, these drain to River Calder.

POLLUTION PREVENTION SITE SPECIFICS:

- Most run-off is over yards direct to Canal. The only drain is adjacent to Biodiesel Plant, which has an air valve which should normally be CLOSED. This bunded area can store approx 6,000 litres of fire water (see plate 1).
- Biodiesel Plant is regulated by Environment Agency (IPPC/EPR) and an emergency plan for this area is in place.
- No drains in storage yard or parking area, run-off direct to Canal.
- Spill kits available on site.
- Foul sewer connection to front of buildings only.



Foul Sewer

Surface Water

Appendix 4

Notification criteria

Fire control room officers should automatically inform environment agencies when notified of incidents involving:

- All hazardous materials, excluding gases, except where a water spray/fog is used to contain or disperse a gas cloud eg chlorine or ammonia
- Pesticides or fertilisers
- Major incident is declared
- Four pumps and/or two or more jets in use and/or HVPs in use
- Firefighting foam is used, excluding domestic fires
- A 'controlled burn' is being undertaken or considered
- Flooding of property from watercourses
- CBRN and/or the use of mass decontamination procedures
- Radioactive materials
- Hazardous fly-tipped waste
- Hazardous waste absorbed by one grab pack or more
- Illegal burning of waste or fires involving burning of waste (above domestic quantities) (notification may originate from member of the public and not involve attendance of FRS)
- Environment agency-regulated sites (eg COMAH, landfills, scrap yards)
- An identified high-risk unregulated site agreed between the FRS and the local Environment Agency (eg timber treatment sites).

Threshold quantities

Additionally environment agencies should be notified when it is confirmed that quantities of products involved reach the following thresholds:

- 25 litres of oil or fuel
- 25 litres or more of detergents eg washing powder, washing-up liquid, shampoos, soaps, car cleaning products, etc
- 25 litres of disinfectants including household bleach, Dettol, etc
- 25 litres of all types of paints and dyes
- More than 25 litres of cooking oils, glycerine, alcohols

- More than 25 litres of cutting lube or water-soluble polymers
- 250 litres of food products. Of particular concern are sauces, sugars, salt, syrups, milk, cream, yogurt and vinegar
- More than 250 litres of any beverage, including all soft drinks, beers, lagers, wines, spirits
- More than 250 litres of other organic liquids, including blood, offal, farmyard slurries, fire-fighting foam, sewerage sludge, anti-freeze
- More than 500 kg of sand, silt, cement, chalk, gypsum/plaster.

These threshold quantities are provided as an illustration. In the event of a spillage of any of these substances environment agencies should always be contacted if more information is required about the possible effects. In environmentally sensitive areas, especially during 'low water flow' conditions, notification to environment agencies may be required below these thresholds.

It is often difficult to decide what quantities of polluting product are likely to result in damage to the environment. As a general rule, Incident Commanders should inform environment agencies when '**above normal domestic quantities**' of products are involved in incidents or enter drainage systems. Ideally, notification that a pollutant or polluting activity is about to impact the environment should take place as early as possible. The following are examples of situations when notification should be initiated by Incident Commanders:

- Polluting materials are likely to, or have entered drains or a watercourse
- Decontamination of personnel is about to take place
- Before or when firefighting foam is deployed, excluding small car fires
- Incidents are on or adjacent to watercourses
- Stacked waste material such as tyres, fridges, etc are involved in fire
- Before decontamination of operational equipment, unless in previously agreed areas.

This is not a definitive list and at times there may be incidents that do not fall into any precise category and if any doubt exists the environment agencies should always be contacted.

Appendix 5

Extracts from Incident Case Study: The Sandoz Warehouse Fire, 1986

By Ian S. Hill, MIFireE North Yorkshire Fire & Rescue Service

The fire

The city of Basle in Switzerland is located on the banks of the river Rhine, which flows on through Germany and France to the Netherlands, where it discharges to the North Sea.

At midnight on the 1st of November 1986, a fire occurred at the Muttenz works, in Basle, close to the river. The fire was confined to a single-storey warehouse, numbered 956, which was erected in 1967. This was an asbestos cement-clad, light steel framework building of 90 by 25 metres in dimension. The roof was of pitched construction with a 13 metre ridge height. The warehouse was separated from adjacent buildings by roadways of 15 metres width.

On the day before the fire, the building was fully stacked, four pallets high with mainly finished chemicals, including flammable materials, pesticides, fungicides and other toxic products. The pesticides inventory included organophosphorus and mercury compounds. In total, the warehouse contained 34 chemical substances with a total inventory of 245 tonnes. Products were not segregated.

On the afternoon prior to the fire, routine work including shrink-wrapping of 20 kg paper sacks of ferric ferrocyanide was being carried out. This process involved heating the plastic film using an LPG powered heat gun. At 1600 hours work in the warehouse finished and staff left for the weekend.

At 2205, the watchman made his round; all appeared quiet. At 0019, a policeman patrolling the highway which bisects the site noticed flames coming from the roof of building 956. Simultaneously, the night watchman observed the same thing. Both individuals raised the alarm.

A few minutes later, the Incident Commander of the works fire service arrived with three firefighters and their equipment. Attempting to enter the warehouse via a service door, the officer found conditions untenable and was forced to withdraw, but not before he had observed the fire was well alight in one section of the warehouse.

Assessing the situation, he raised a full alarm at 0025 hours. At 0030 hours, further fire appliances arrived with 15 firefighters. Soon appliances from adjacent chemical plants and the local and municipal fire service arrived. By 0045, there was a total of 200 firefighters on site.

Despite a spirited initial attack, firefighting operations were soon impeded by the ferocity of the blaze and combustible liquids stored externally along the outside walls which were igniting and spreading fire. It was therefore decided to initiate a controlled burn strategy. However, the building was subject to progressive collapse during the next four hours. Eventually, drums of materials began being ejected high into the air landing on adjacent buildings that contained combustible and water-reactive chemicals. The Incident Commander then decided to change tactics to offensive with the aim of preventing the fire from spreading to these buildings.

In order to supply the high volume of water necessary to extinguish the fire, the Rhine Harbour fire boat was got to work pumping many thousands of litres from the river onto the fire. The firefighting action was successful, as the fire was prevented from spreading to other buildings and no serious injuries were sustained. It is estimated that at the height of the incident some 40,000 litres/min of water was being supplied to the fireground. A significant proportion of the firewater ran unimpeded from the site directly or through drainage systems that discharge into the river.

Over the next few days it became apparent that the Rhine had been seriously polluted by the contaminated firewater. Almost all life in the river had been destroyed for a distance of over 400 km downstream of the fire. The incident also led to the closure of public drinking water abstractions in several countries and warnings to farmers not to use water for stock watering or irrigation.

Many local people were affected with symptoms of headaches, dizziness, sneezing and running noses and eyes. A ban on the consumption of locally grown foodstuffs was eventually imposed, to be lifted only after extensive tests had been carried out.

The Basle incident has, with some justification, been described as one of the worst man-made ecological disasters.

The pollution

The pesticides and other chemicals that had been stored in building 956, and entered the river Rhine, had been designed specifically for the destruction of microscopic organisms, plants and animals. In the river, this purpose was fulfilled to devastating effect. The run-off contained approximately 30 tonnes of chemicals either in solution or suspension. The silt on the bed of the river was sampled and shown to be contaminated to a point at least 15 km downstream of the fire. It is estimated that at least 200 kg of mercuric compounds settled into the silt layer.

Of the chemicals that were left in solution, a ‘slug’ at least 1 km in length slowly progressed along the river to the North Sea. The first indication that anything was amiss was the sighting of small numbers of dead fish. From this, it was assumed that the ecological damage inflicted by the fire was relatively small. However, as the days after incident passed, it became evident that the damage was greater than was first thought.

In the Swiss and German Rhine, virtually the entire eel population was wiped out. Certain reaches of the river were officially declared dead, with all life having been obliterated.

Water abstraction from the river was also badly affected, both for drinking, livestock watering, irrigation of crops, recreation and industrial purposes. As the slug progressed into the Dutch Rhine the authorities were able to take some measures such as the closing of sluices.

It was estimated that the river was not back to its former condition for around 10 years, owing to the disruption of ecosystems down to the lowest trophic levels. It would have been of little use restocking the river with animals such as fish if there was nothing for them to live on. The microbiological life of the river must first be re-established before higher level animals can return.

The investigation 1 – the fire

The Zurich City Police, who were the incident investigators, eventually decided that there were two likely causes for the fire – malicious ignition or spontaneous combustion of the palleted chemicals.

The workers in Building 956 were engaged in the shrink-wrapping of pallets of ferric ferrocyanide. During the investigation, it was found that this product could undergo exothermic decomposition if it was heated. Once the decomposition was initiated, it was found to progressively 'tunnel' into the sacks without the evolution of noticeable smoke or odour, until sufficient heat was generated to initiate an outbreak of fire. This would explain why the night watchman did not notice any untoward signs when he inspected the warehouse some hours before the fire was noticed.

The arson theory was supported by the fact that Sandoz had recently instituted a redundancy programme which made it a likely arson target. Furthermore, it is not inconceivable that the company was attacked by ecological or animal rights groups concerned about company policy in areas connected with their campaigns.

Eventually the exothermic reaction theory was identified as the most likely cause.

The investigation 2 – the pollution

The topography and construction of the site, coupled with the hazardous chemicals stored and the lack of pollution control facilities, made a major pollution incident inevitable in the event of a large fire. The problem was one of perception prior to this incident; in the early 1980s, firefighting arrangements and environmental protection shared little in common.

The disaster was caused when large volumes of contaminated run-off from the fireground entering the site's surface water drainage system from where it flowed directly into the River Rhine. This was able to happen due to lack of:

- Water or foam sprinklers
- Bunding of the warehouse area
- Containment system fitted to the site drainage system
- Procedures/equipment in place to ensure firefighters could manage/ contain firewater.

Had such systems/procedures been present, the run-off of firewater could have been minimised or contained. Without the measures, there was little chance that the volume of water used to extinguish the fire could be contained.

If a sprinkler system had been installed, the amount of water which would have secured extinction has been estimated to be 2–3% of that applied by the firefighters. Such a volume would have been easy to contain if the environmental protection measures described above had been in place (see PPG 18, found on www.environment-agency.gov.uk).

A policy of the controlled burning of agrochemical stores and warehouses has been advocated if the containment of all or a significatn proportion of the firewater is not possible, although before doing so consideration of the likely toxic emissions to air and the risk of the fire spreading should be considered (see PPG 28, Controlled Burn, found on www.environment-agency.gov.uk).

Since the fire, the owners of the site have invested heavily in state-of-the-art fire prevention and pollution control systems, making the likelihood of such an incident ever occurring again remote.

Appendix 6

Example Fire and Rescue Service pollution prevention and control reporting and recording form

Please tick all relevant shaded boxes

1. Event Details

FRS Incident Ref Number:	**Time of call (24-hr clock)**	**Date**
Incident address	**Location description, e.g. river, roadway etc**	
Fire and Rescue Service attending	**Fire stations ground**	
Who reported the event? (if known) **Name:** **Address**	**Position:**	

2.What happened?

Brief description of event: e.g. RTC, split fuel tank, overturned tanker etc					
Category of pollutant please include quantities in litres and description e.g. milk, hydrochloric acid etc					
	Oil/fuel	**UN classified**	**Low-hazard: inks, dyes etc**	**Organic: milk, blood etc**	**Inorganic: silt, cement etc**
Total inventory					
Estimated total spilt					
Estimated total contained by FRS					
Estimated total escaped into i) surface water environment					
ii) ground					
Estimated quantity fire run-off water containing					

EA/SEPA or NIEA informed	**YES**		**NO**	
EA/SEPA/NIEA attended	**YES**		**NO**	
Name of agency officer: attended or contacted (please specify)	**Contacted**		**Attended**	

Person responsible for incident premises/vehicle/land **Name:** **Position:** **Contact details:**
Most likely cause of event e.g. fire run off, spillage, RTC, ruptured vehicle fuel tank etc:
If a pollution impact category allocated by environment agency, please specify **Category** 1 ☐ 2 ☐ 3 ☐

3. Actions

Were any pollution prevention measures deployed before arrival of FRS, please describe and ID who took action
Description of equipment quantities and pollution control techniques used by FRS **Drop-down menus – equipment to order tick box**
Were any improvised actions taken by FRS e.g. use of soil, sand etc – please describe

6. Are there any development or learning issues that may be useful in the future?

Please describe

Resources deployed	**Emergency**	**Non-emergency (contracted)**
How many person hours were spent on emergency and non-emergency phase pollution control activities during this event Include total hours of all FRS personnel allocated to specific task		
Type and number of FRS vehicles deployed for Pollution Prevention/protection work (only)		

Signed	**Date**
Role	
Name	

Please email this form to

Note: This form has been produced as a guide and should be amended to suit local needs as necessary.

Acknowledgements

Mr Bill Alkinson – National Chemical Emergency Centre

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Mr Kevin Miller – Hazmat Link

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Severn Trent Water

Mr David Stotesbury – Barrister

Mr John Wakefield (Oxfordshire FRS)

Douglas Watt – Scottish Environmental Protection Agency

Abbreviations

7(2)(d)	Section 7(2)(d) of The Fire and Rescue Services Act 2004
ATFs	Authorised Treatment Facilities
BOD	Biochemical oxygen demand (also known as biological oxygen demand)
CAFS	Compressed air foam systems
CBRN	Chemical, Biological, Radioactive, Nuclear
CFOA	Chief Fire Officers Association
COMAH	Control of Major Accident Hazards
CPR	Counter-Pollution and Response (MCA)
CPSO	Counter-Pollution and Salvage Officer (MCA)
DEFRA	Department for Environment, Food and Rural Affairs
DRA	Dynamic Risk Assessment
EC	European Community
EIR 2004	Environmental Information Regulations 2004
ELV	End-of-Life Vehicle
EMAS	European Eco-Management and Audit Scheme
EMS	Environmental Management Systems
EPU	Environmental Protection Unit
ESA	Environmental Services Association
FRS	Fire and Rescue Service
GIS	Geographical Information System
HMCG	Her Majesty's Coastguard
HMEPO	Hazardous Materials and Environmental Protection Officer
HNS	Hazardous and Noxious Substances (MCA)

HNS RT	Hazardous and Noxious Substances Reponse Team (MCA)
HVPs	High-volume pumps
IEMA	Institute of Environmental Management and Assessment
IPPC	Integrated Pollution Prevention and Control
IRMP	Integrated Risk Management Plan
ISO 14001	International Standards Organisation, Environmental Management System Standard
LGA	Local Government Association
LRF	Local Resilience Forums
LRAG	Local Risk Assessment Guidance (CCA)
MCA	Maritime and Coastguard Agency
MIRG	Marine Incident Response Group
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NAIR	National Arrangements for Incidents Involving Radiation
NAMOS	National Arrangements for Marking of Sites Regulations 1990
NCEC	National Chemical Emergency Centre
NCP	National Contingency Plan (MCA)
NEOG	National Environmental Operations Group
NESG	National Environmental Strategy Group
NI	Northern Ireland
NIFRS	Northern Ireland Fire & Rescue Service
NIEA	Northern Ireland Environment Agency
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PPC	Pollution Prevention and Control (Act and Regulations)
PPE	Personal Protective Equipment

PPG	Pollution Prevention Guidance
Radsafe	Health Protection Agency (Radiation Division) scheme for dealing with transport incidents involving radioactive material
RRP	Risk Reduction Plan (Wales)
RTC	Road traffic collision
SEPA	Scottish Environmental Protection Agency
SOS REP	Secretary of State's Representative
SSSI	Sites of Special Scientific Interest
UK	United Kingdom
UKAS	UK Accreditation Service
UKSpill	UK Spill Association
UN	United Nations
UV	Ultra Violet
VMDS	Vehicle-Mounted Data System
WLGA	Welsh Local Government Association

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www.water.org.uk/hme

Glossary of terms

Absorbents	Materials that take up (absorb) a pollutant within their structure
Aquifers	Underground areas in permeable rock that contains water
Ecology	The relationships between plants and animals
Eco-toxic	Toxic to plants and animals
Entrophy	A measure of disorder
Eutrophic	Nutrient rich
Hazmats	Hazardous materials including chemical, biological, radioactive, nuclear and hazardous fibres
Protists	Organisms with a nucleus, usually unicellular, although some of the algae can be multicellular. They are not classified as plants, animals or fungi
Trophic levels	Levels of the food chain

Notes

Notes

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Fire Service Operations

Environmental Protection

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