ENVIRONMENTAL GUIDELINES FOR PETROLEUM DISTRIBUTION INSTALLATIONS

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November 2006

Published by
ENERGY INSTITUTE, LONDON
The Energy Institute is a professional membership body incorporated by Royal Charter 2003
Registered charity number 1097899

The Energy Institute gratefully acknowledges the financial contributions towards the scientific and technical programme from the following companies:

BG Group	Maersk Oil North Sea UK Limited
BHP Billiton Limited	Murco Petroleum Ltd
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ENI	Talisman Energy (UK) Ltd
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Kuwait Petroleum International Ltd	Total UK Limited

ISBN 978 0 85293 440 1
Published by the Energy Institute

Further copies can be obtained from Portland Customer Services, Commerce Way,
Whitehall Industrial Estate, Colchester CO2 8HP, UK. Tel: +44 (0) 1206 796 351
email: sales@portland-services.com

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ACKNOWLEDGEMENTS

The Energy Institute wishes to record its appreciation of the work carried out by Brian Smithers, as author of these Guidelines.

The production of these Guidelines has been jointly steered by the Energy Institute (EI), the Environment Agency for England and Wales (EA), and the Scottish Environmental Protection Agency (SEPA). The EI would like to thank members of the Steering Group for their efforts in guiding the project to completion. In particular:

Hugh Bray	TSA
Teresa Brown	EA
David Campbell	SEPA
Phil Chatfield	EA
John Davys	Total
Dave Hughes	ConocoPhillips
Martyn Lambson	BP
Gordon Lethbridge	Shell Global Solutions
Mike Longman	ExxonMobil
Ian McPherson	UKPIA
Martin Maeso	EI
Mark Maleham	EA
Jim Maxwell	ExxonMobil
Rex May	BP
David Mercer	Vopak
Mark Morton	EA

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INTRODUCTION

1.1 PURPOSE OF THE GUIDELINES

The need for good environmental performance has always been a requirement within the oil industry. Moreover, actions to minimise the release of hydrocarbons to the environment can also lead to improvements in safety performance, healthier working conditions for employees and more cost-effective operations.

This document updates the Guidelines for petroleum distribution installations first produced in 1996. Their purpose is to outline best practice for the optimisation of environmental performance, in particular the prevention of leaks and spills that may adversely affect surface and groundwater, and soil. A revision of these Guidelines has been undertaken to update current best practice and to fill a void in guidance particularly on the protection of ground and groundwater. In particular, these Guidelines emphasise that risk assessment is a key tool in environmental management.

Existing guidance and legislation covering oil storage is in place for a number of industrial sectors. In the European Union, facilities such as refineries are regulated by the EU IPPC Directive[1] and have guidance in the form of the EU Reference Documents on Best Available Techniques (BREFs)[2,3]. In England, industrial and commercial businesses where oil is stored are controlled through the Control of Pollution (Oil Storage) (England) Regulations 2001[4] which outline the provisions for the design of storage facilities at these sites. Similar regulations are in force in Scotland[5] and are planned elsewhere in the UK. Petroleum distribution installations, such as terminals and authorised distributor depots, fall outside the scope of both the IPPC Directive and the Oil Storage Regulations in England and Scotland, and this has promoted the need for these revised Guidelines.

This revision of the Guidelines was undertaken before the explosion and fire at the Buncefield distribution terminal. Further revision to include the lessons learned from that incident may be required once the investigation has been completed.

1.2 LEGISLATIVE FRAMEWORK

These Guidelines are intended for international use but, where appropriate, reference is made to EU and UK legislation. Table 1 summarises the key European environmental legislation impacting petroleum distribution installations and Annex A outlines the major UK environmental regulations.

Until recently, the main EU legislation to protect groundwater has been the Groundwater Directive[6]. Within the UK, the requirements of this Directive are delivered through the various legislative instruments noted in Annex A. This includes consents and authorisations or the use of discretionary powers. The Water Framework Directive (WFD)[9] will repeal the Groundwater Directive in December 2013, but European Member States must retain at least an equivalent level of protection to groundwater. A Groundwater Daughter Directive is proposed to provide more details on the requirements of the WFD.

Table 1: Summary of main European legislation for the control of environmental hazards

LEGISLATION	PURPOSE	MAIN REQUIREMENTS
EU Groundwater Directive 80/68/EEC[6]	Protection of groundwater from the release of dangerous substances.	Controls on the discharge or disposal of dangerous substances, as well as powers to control other activities that may result in their release to groundwater.
EU Natural Habitats Directive 92/43/EEC[7]	Conservation of natural habitats.	Designation of special areas of conservation. Measures to protect the habitats in these areas and to avoid their deterioration.
EU Seveso II Directive 96/82/EC[8]	Reduction of risk of industrial accidents to protect people and the environment.	Control of the consequences of industrial accidents through risk analyses to predict the circumstances of likely accidents and the use of measures to reduce risk as low as reasonably practicable (ALARP).
EU Water Framework Directive 2000/60/EC[9]	Provide a framework for the protection of all waters – rivers, lakes, coastal waters and groundwaters. Promote sustainable water use, progressively reduce pollution and prevent deterioration of aquatic ecosystems.	Sets a range of environmental objectives, including the achievement of good status for all water bodies. For groundwater, deteriorating trends in quality must be reversed and pollutant inputs must be prevented or limited.

Environmental protection is a major consideration in the control of the consequences of industrial accidents. The Seveso II Directive[8] is implemented in the UK through the Control of Major Accident Hazards (COMAH) Regulations[10]. These regulations apply at two thresholds (top and lower tier sites) depending upon the quantity of dangerous substances stored. For petroleum products, which are defined as gasolines and naphthas, kerosenes (including jet fuels) and gas oils (including diesel fuels, home heating oils and gas oil blending streams), the thresholds for the two tiers are 25 000 te and 2 500 te respectively. Many petroleum distribution installations are therefore impacted. The regulations require measures to prevent major accidents and mitigate their effects by:

- Undertaking risk analyses to understand and predict the circumstances of such incidents.
- Taking the necessary measures to reduce risk as low as reasonably practicable (ALARP).

Under COMAH, the site needs a major accident prevention policy (MAPP) document that demonstrates the adequacy of the safety management system in place. In addition, top-tier sites need to produce a safety report and an on-site emergency plan covering the actions needed in the event of an accident. Environmental issues covered in this include:

- Identifying and assessing major accidents.
- Putting in place measures to reduce the risk of accidents.
- The command structure for managing the on-site response.
- Actions to be taken to control an accident and limit its consequences.
- Training of site personnel.

Guidance is provided in HSE publication L111, *A Guide to the Control of Major Accident Hazards Regulations, 1999* [11].

The Storage BREF[3] provides guidance for sites regulated under the IPPC Directive[1] on the best available techniques (BAT) that can be implemented at a new facility. The Storage BREF is also used by regulators in the UK to identify best practice for

COMAH sites. For existing installations the BREF recognises that both technical and economic considerations must be taken into account on a site specific basis to establish to what level BAT or best practice can be achieved.

These Guidelines identify where risk assessments should be used e.g. to establish the adequacy of storage tank secondary containment. This type of information will be required for the Safety Report and the Safety Management System at COMAH sites.

A comprehensive list of the legislation and guidance currently available relevant to the design, manufacture, installation, operation and maintenance of above ground storage systems is given in CIRIA Publication C598, *Chemical Storage Tank Systems – Good Practice*[12]. Guidance is also given in the HSE publication HS(G)176, *The storage of flammable liquids in tanks* [13].

When underground storage tanks are installed at petroleum distribution installations, the same general principles outlined in these Guidelines should be followed. Additional guidance is provided in the Scottish Executive publication *Underground storage tanks for liquid hydrocarbons: Code of practice for the owners and operators of underground storage tanks (& pipelines)* [14] and the DEFRA document *Groundwater protection code: Petrol stations and other fuel dispensing facilities involving underground storage tanks* [15].

In countries outside of the United Kingdom reference should be made to local legislation and recognised best operating practices.

1.3 WHO SHOULD USE THIS GUIDANCE?

The Guidelines provide guidance for the following personnel:

— Owners of petroleum distribution terminals and authorised distributor depots.
— Those involved in the operational management of those facilities.
— Those involved in inspection and maintenance.
— Those involved in engineering design and construction.
— Those involved in commissioning and de-commissioning.
— Those involved in regulating such facilities.

1.4 SCOPE

The Guidelines focus on the design and operation of liquid petroleum fuels distribution installations. However, the principles outlined may also be used at other sites e.g. LPG, bitumen, aviation, lubricant operations, refinery off-sites, and bulk liquid storage terminals. However, it should be noted that these other facilities will have their own additional specific considerations to be taken into account which are not addressed here.

The principles outlined in these Guidelines apply to the storage and transfer facilities for products used on-site as well as to those for onward distribution.

The Guidelines do not deal with the control of vapour emissions. The control of vapours from gasoline storage and loading at the great majority of petroleum distribution installations is already mandated by the European Directive 94/63/EC[16]. Guidance on implementing these controls is provided in the IP *Guidelines for the design and operation of gasoline vapour emission controls* [17].

The Guidelines also do not deal with oil spills onto surface water. Guidance on inland water oil spill response can be obtained in the joint Institute of Petroleum and Environment Agency publication[18] and on the use of oil spill dispersants at sea in reference[19].

1.5 ENVIRONMENTAL MANAGEMENT

1.5.1 Control philosophy

A fundamental philosophy presented in these Guidelines is that wherever possible "prevention is better than cure". If an effluent, emission, waste or spill is not generated it does not have to be cleaned up. For storage, the focus should be on maintaining the integrity of primary containment.

To implement this very basic philosophy it is necessary to raise the level of understanding of all personnel on how to operate existing equipment and facilities to get the best environmental performance. Improved practices and procedures can eliminate a pollution source at low cost. Designing systems to prevent emissions at source is more cost effective than having to control the effluent once emitted.

1.5.2 Environmental management systems

These Guidelines concentrate on the practical means of minimising the potential environmental impact of petroleum distribution installations. The driving force for this process should be the Environmental Policy of the organisation which controls the operation of the installation. Little will be achieved unless the company management is committed to good environmental performance. The Environmental Policy will set the broad long-term objectives without giving details of how they are to be achieved. The Environmental Management System (EMS) then provides a structured means of deciding what has to be done to satisfy policy requirements. This should be an integral part of the normal management process.

The main elements of an EMS should include:

— Planning the implementation of the environmental policy.
— Organisation and communication.
— Implementation.
— Control and verification.
— Revision of plans.
— Emergency response plans.

1.5.3 Risk assessment

Risk assessment is a key tool in environmental management. It should be used to appraise design and control options and establish the optimum cost-effective solutions. The basis of risk assessment considers the following:

— What are the hazards e.g. tank over-fill?
— What is the probability of a hazard occurring e.g. how often could such an over-fill occur, taking into account installed systems and operating practices?
— What are the consequences if a hazard does occur e.g. what effect could the product spilt have on surface water, groundwater, land, etc.?
— What can be done to reduce the probability of the hazard occurring e.g. what measures (such as high level alarms, inventory checks, etc.) have not been installed and could be considered to reduce the likelihood of an over-fill?
— What can be done to mitigate the consequences of the hazard occurring e.g. what measures (such as partial bund lining) have not been installed and could be considered to reduce the environmental impact of an over-fill?

As an additional aid in the risk assessment process, a conceptual understanding or 'model' of the site under review can be produced. A conceptual model is a simplified representation of how a real system is thought to behave, based on qualitative analysis of field data. For groundwater pollution, conceptual modelling uses available information to provide a 'picture' of how the groundwater flows and interacts in the environment. The conceptual model is then tested against reality and, if necessary, refined and tested again until it is good enough to provide reasonable predictions. Conceptual models should be reviewed and refined in the light of experience and as new data become available. Figure 1 shows an example of a detailed conceptual model diagram. In practice the diagram does not need to be this detailed, but should contain all the relevant model information.

Having estimated the magnitude and significance of the risk (the probability of the occurrence of an adverse effect caused by a hazard), the options for risk management can be evaluated using, for example, cost effectiveness studies.

General guidance on the application of risk assessment is available in the joint DETR, EA and IEH publication *Guidelines for environmental risk assessment and management* [20]. Guidance on risk assessment methodologies to establish the need for, and extent of, storage tank bund lining is provided in the Storage BREF[3] and in the EI publication *A risk-based framework for assessing bulk liquid storage facilities*[21].

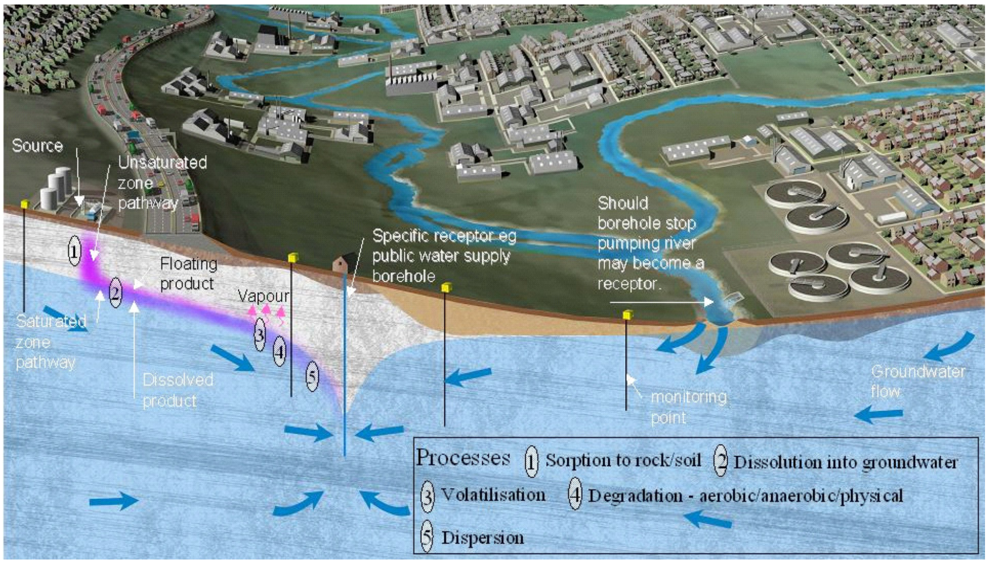

Figure 1: Groundwater pollution conceptual model diagram

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USING THE GUIDELINES

2.1 USING THE GUIDELINES FOR A PARTICULAR FACILITY

These Guidelines apply to a wide range of facilities and the appropriate level and measures for environmental protection will vary from site to site.

In determining how the Guidelines should be applied at a site, it is necessary to take account of:

- Nature and volumes of products stored.
- The age, type and construction of the facility.
- Inspection and maintenance regimes in place.
- Operating and integrity management practices.
- Maturity of the Environmental Management System (see section 2.2.3).
- The location and environmental setting of the facility (e.g. types of underlying geology, the depth to groundwater and the proximity of surface water).
- Pathways to groundwater, surface water, people or property.
- The sensitivity of potential receptors.
- Potential effect of a major accident on the surrounding environment.

These factors should be considered in a risk assessment to determine the need for any necessary modifications to reduce environmental risk. The risk assessment would review the practical engineering options available to reduce emissions and the costs and benefits of such control measures.

2.2 THE KEY ELEMENTS TO ENSURE ENVIRONMENTAL PROTECTION

To protect the environment against potential pollution, the following steps should be taken:

- Undertake a risk assessment (section 2.2.1).
- Use the results to:
  1. Establish the operational and engineering control measures required (section 2.2.2).
  2. Implement appropriate operational management systems and controls, including monitoring (section 2.2.3).
  3. Prepare emergency plans and procedures (section 2.2.4).

This approach applies throughout the lifetime of a facility, from design conception through to demolition, although the sources of risk and their method of management will vary. These Guidelines review these issues in the design, commissioning, operation and de-commissioning stages.

2.2.1 Environmental risk assessment

The undertaking of a risk assessment is critical in identifying the potential risks of pollution to all environmental media – air, surface water, land and groundwater. Risk assessments need to review the potential impact of any emissions to the environment, taking account of source, pathway and receptor considerations. Sites impacted by COMAH regulations are required to undertake risk analyses to understand and predict the potential consequences on the environment of a major accident.

Although air is not considered in these Guidelines, the Storage BREF[3] provides risk based methodologies to establish optimum control measures for storage tanks covering potential discharges to all environmental media, including the atmosphere. The BREF takes into account emission reduction requirements, operational aspects and costs.

Risk assessment is the process of estimating the probability of the occurrence of an adverse effect caused by a hazard. It is a step-wise process:

1. Identification of the potential hazard e.g. a leak of hydrocarbons from a tank. This should be specified clearly and, if possible, in a quantified way.
2. Identification of the consequences and the estimation of their magnitude. Where the magnitude of the consequences is significant this may need to be quantified, otherwise it may be possible to express these qualitatively, e.g. severe, moderate, mild, negligible.
3. Estimation of the probability of the consequences. This should take account of:
   – the probability of the hazard occurring. It is often difficult to do this in a mathematical way - whether this can be expressed qualitatively will depend on the circumstances.
   – the probability of the receptor being exposed to the hazard. If there is no pathway between the source and receptor then the risk requires no further attention.
4. Evaluation of the significance of the risk. This requires value judgements to be made through reference to pre-existing measures, thresholds or standards. A simple matrix of consequences versus probability can provide a consistent basis for decision making. The factors influencing the significance of risk include statutory and policy requirements and economic factors. The former may limit acceptable risk to that deemed 'tolerable' or as low as reasonably practicable (ALARP).

This methodology can be an iterative process, enabling different risk reduction options to be reviewed, with the reduction in risk being balanced against both practicability and the costs involved.

The risk assessment should identify the potential sources (e.g. from leaks, spills, tank over-fills, etc.) and possible pathways to groundwater, surface water, land and areas identified as requiring protection through the Habitats legislation[7].

In addition to being a potential pathway to other receptors (such as streams or drinking water abstractions), groundwater has its own legal protection. There is a requirement to prevent certain substances (List I substances as defined in the Groundwater Directive[6]) from reaching groundwater; most hydrocarbons are classified as List I substances in the UK. This should be the first step in a risk assessment that includes groundwater as a receptor or pathway.

As a second stage, in order to assess the risk of pollution from an incident, the impact on drinking water supplies, local amenities, other abstraction points, etc., can be established. This can help with prioritising a work programme for individual pieces of equipment or facilities.

However, the requirement to prevent the introduction of List I substances to groundwater has to be recognised. Note that there are many substances outside List I that whilst less hazardous may still cause groundwater pollution. Many of these substances can also cause pollution of surface water and their discharge without a consent or permit is prohibited. Furthermore, the Water Framework Directive[9] significantly broadens the range of substances defined as pollutants and prohibits their direct discharge to groundwater.

Having established the magnitude and significance of the risks, the options for risk management are identified and evaluated. The option chosen will involve a balance between risk reduction, costs and benefits.

Costs for retrofitting some measures can be significantly greater than when implemented from new. Thus options for new build facilities and retrofit may be different. Moreover, retrofitting measures in an operating site may introduce additional safety or environmental hazards which will need to be carefully considered.

It should be remembered that pathways and receptors can change throughout the life of a facility (e.g. due to changes to drainage systems, surrounding developments, etc.). Risk assessments, therefore, should be reviewed at appropriate regular intervals.

The findings of the risk assessments should be used to draw up a risk management action plan, which would be included in the site EMS. This management plan should include measures to prevent loss of product (i.e. risk avoidance and risk control) and not just measures to mitigate the impact once a loss has occurred. It should outline the engineering and operational controls required.

It is stressed that the focus should be on measures to prevent product loss. For example, the design and operation of an installation should ensure that the integrity of primary containment is maintained in the long term.

Further details of risk assessment methodologies are given in the joint DETR, EA and IEH publication *Guidelines for environmental risk assessment and management* [20].

2.2.2 Engineering requirements

The risk assessment process will establish the operational and engineering control measures required. The latter should be implemented according to the latest edition of appropriate Industry Standards and Codes of Practice. A comprehensive list for storage facilities is provided within the Storage BREF[3]. Both new and retrofit equipment should be designed to minimise the possibility of failure potentially leading to emissions. Maintenance should also follow the same philosophy.

Defining and implementing environmental controls at the design stage is usually the best and cheapest option. Where measures have to be retrofitted, particular care should be taken during installation to minimise the risks to safety and the environment.

Where major changes to an installation or new projects are planned it is important to carry out an assessment of their possible effect on the environment. This can be undertaken using the risk assessment methodologies described above. Such an assessment should also include a cost effectiveness study to help in planning changes and future projects.

2.2.3 Management systems and controls

No matter how well engineered a facility may be, it is ultimately the correct use, inspection and maintenance of those facilities which will dictate their effectiveness. The development and implementation of appropriate management systems and controls, therefore, are essential. These are required not only for operating facilities but also when a site has been closed to ensure that there is no unacceptable risk of pollution from unused equipment, tanks, etc.

The implementation of an Environmental Management System (EMS) is good evidence of a facility being operated in an environmentally responsible manner. The EMS may be part of an overall site Safety, Health and Environment Management System (SHE-MS). Sites impacted by the COMAH regulations will also need a major accident prevention plan (MAPP).

An Environmental Management System (EMS) defines the organisational structures, responsibilities, operational measures and resources required to implement the company's Environmental Policy and to monitor and control performance. Amongst other things, it should take account of local requirements and specific Industry initiatives and should ensure that environmental considerations are continuously integrated into business decisions in a systematic way.

The central concept of the Environmental Management System is the sequence of planning, organisation, execution and control, as detailed in the following sections and shown in the flow chart in Figure 2.

2.2.3.1 Planning

The plan should be reviewed regularly, usually annually, as follows:

- Assess the environmental performance of current operations against statutory consents and company standards.
- Review progress against the existing plan.
- Identify improvements and changes needed. These may include education and training of the workforce and changes in organisational culture and workforce behaviour as well as changes in practices, procedures and equipment.
- Review regulatory and legislative developments.
- Review developments in public attitudes and perceptions.
- Modify the company environmental objectives to take account of these developments
- Maintain a dialogue with the regulatory authorities.

The formulation of short-term plans within the framework of the long-term strategy will enable staff to monitor progress towards the eventual objectives and to make adjustments and changes as necessary to ensure achievement.

2.2.3.2 Organisation and communication

Responsibilities

Environmental protection and performance against consents and standards should be a line management responsibility for which staff at all levels are accountable. Improvements in both areas can only be made with the full support of all employees. Each employee should understand the potential impact of their work upon the environment and their personal responsibilities for its protection.

Line management is also responsible for developing environmental policy, drawing up plans to implement that policy and reviewing progress against those plans. Management may be assisted in these processes by specialist advisors.

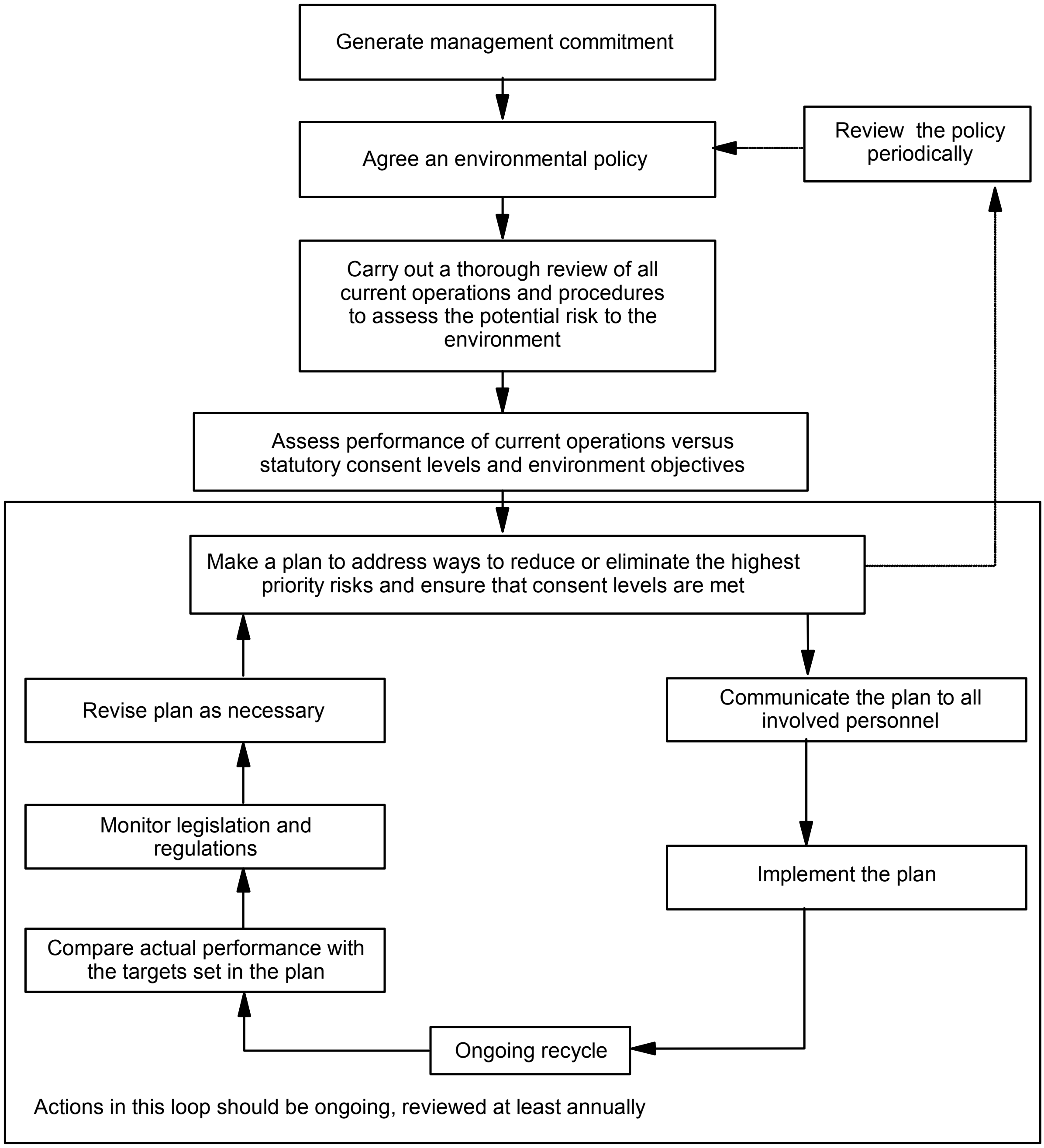

Figure 2: Environmental management process

Information and training
A lasting improvement in environmental performance can only be attained with the full support of all operating personnel. To earn this support it is essential to raise environmental awareness amongst personnel both full time and contract, so that they have a clear understanding of what the organisation is trying to achieve and why. All personnel at an installation should be encouraged to contribute to the process of reducing the potential impact of plant operation on the natural environment.

In addition to refreshing and reinforcing HSE training, it is essential that personnel are trained when existing standards are changed, or new ones established, in order to take account of environmental requirements.

Standards and procedures
Existing standards and procedures within organisations may not fully recognise the requirements of newly established environmental policies. These should be regularly reviewed and updated to take account of changing environmental objectives.

Communication
Communication at all levels within the organisation is required if the EMS is to be effective in improving environmental performance. It is recommended that communication is made principally through line management, but supported by both formal and informal mechanisms such as publications within the organisation. Communication is more effective if it is a two-way process and the transfer of ideas and experience, both up and down through the organisation, should be encouraged.

External communication is necessary if good working relationships are to be established with regulating authorities, local communities, and organisations representing technical and commercial interests. Any environmental complaints should be recorded along with the action taken and by whom.

2.2.3.3 Implementation
Performance targets, consistent with long-term policy objectives, should be developed for all operations which have an impact on the environment. In addition, realistic short-term targets should be defined so that there is a framework within which performance can be measured and improvements made; these will take account of existing regulatory consents and expected changes, economic constraints and technical and operational developments.

A system of incident recording (both actual and 'near miss') and reporting of failures should be in place to extend understanding of environmental impact and to avoid further failures. Incident investigation and corrective action should be made by line management.

2.2.3.4 Control and review
Performance monitoring, environmental assessments and audits provide the control and review of the effectiveness of environmental protection measures implemented. Performance is improved by raising the environmental awareness of employees. Regular joint assessments involving staff at all levels should be undertaken to establish the improvements made and to identify any areas for improvement.

Environmental performance monitoring should include the following:

— Environmental training.
— Quantitative data on all discharges.
— Any failure to comply with consents.
— Waste types and quantities and associated disposal methods.
— Energy and water consumption.
— Incidents with actual or potential environmental impact.
— Complaints received and their resolution.
— Regulatory interaction.

Reporting and reviewing environmental performance should be a regular process, with the frequency set by the risk associated with the potential environmental impact. Where performance is falling short of expectations, action should be taken to ensure that both short and long-term targets are met.

The results of environmental performance reviews should be communicated to the operational personnel providing the information.

Environmental auditing is a tool that management can use to measure the results of its plans. It should comprise a systematic, objective and fully documented evaluation of the way in which staff and facilities are performing in managing environmental risks.

It is recommended that local management are closely involved in the process of assessment and audit. The results of assessments and audits should be included in the control and verification activity.

2.2.3.5 Revision of plans
Regular appraisals, at least annually, should be made of the results coming from the control and verification processes. Management should consider performance against both short-term and long-term objectives. This provides the structure so that the company can identify and implement any revisions to action plans and strategies within the next review period to maintain the desired progress towards achieving targets. Initiatives for environmental improvement arising from these appraisals form the basis of a further round of the environmental management system loop.

2.2.4 Emergency response plans

In the event of the loss of product, or other incident, the environmental impact will be minimised by prompt and appropriate action. This can be achieved through the preparation of a plan to deal with an environmental incident. This plan should be part of the wider emergency response plan for the installation.

Facilities may need to have rigorous on-site emergency plans under the COMAH regulations. Guidance for sites which do not have a statutory duty to prepare such plans is provided in the Pollution

Prevention Guideline PPG21[22]. In all cases it is important that there should be liaison with the emergency services, local authorities, water services companies and regulators.

The incident response plan should contain procedures for a variety of potential pollution incidents specific to the installation. It should provide details of the site drainage system and potential routes for pollutants to migrate off-site. The procedures should include measures to prevent or mitigate the impact of off-site pollution and also means of reducing the potential risks from measures to deal with the incident, e.g. contaminated fire fighting water. The plan should also include for the disposal of wastes which may arise from an incident and any subsequent clean-up.

The plan should contain a comprehensive contact list providing details of, for example, the emergency services, the relevant regulators, local service suppliers, specialised clean-up contractors and specialists providing advice on the handling of products stored at the installation. It should also provide contact details of key staff.

Copies of the plan should be kept both on-site and at appropriate off-site locations possibly including any specialist contractors used by the facility. A list of all persons holding the plan should be held and kept up-to-date.

2.3 SUMMARY

Risk assessments coupled with cost effectiveness studies should be undertaken to establish optimum control measures to protect the environment. Risk assessments are needed at COMAH sites to meet regulatory requirements.

Engineering should be undertaken to appropriate and up-to-date Standards and Industry Codes.

An Environmental Management System should be in place and reviewed and updated regularly.

Emergency response plans should define the means to deal effectively with environmental incidents.

3

DESIGN

3.1 INTRODUCTION

It is imperative that in all design work the need to minimise the potential for future environmental damage over the lifetime of the installation, including its demolition, is taken into account. This applies to any new installation or the retrofitting of equipment to existing facilities. When designing the facility, emphasis should be placed on hazard prevention and inherent safety rather than risk management i.e. avoid the problems in the first place rather than attempt to control them via engineering and operational solutions.

The main operations within distribution installations are the receipt, handling, storage and loading of products. The design of an installation should ensure that the product is effectively contained on a continuing basis. Two elements are involved in containment: primary and secondary.

Primary containment relates to the equipment and facilities which have direct contact with the products, (e.g. tanks and pipe work), and their operation and management.

Secondary containment relates to both the control of the product in the primary containment facilities (e.g. the provision of tank high level alarms to prevent loss through overfills) and any contingency provisions made for the failure of the primary containment.

The first objective of design is to ensure that the integrity of primary containment is maintained in the long term. In addition to engineering design, there are other measures such as improved operations, inspection and maintenance, etc., which can reduce the probability of product loss.

Liquid product lost can either end up in the aqueous effluent system and be routed to the site oil-water separators (also called interceptors) or permeate into the ground with the potential risk that it can migrate to surface or groundwater.

Proper design of drainage systems and segregation of clean rainwater should minimise the amount of contaminated water flowing to oil-water separators.

For existing storage facilities, risk assessment will dictate the degree of secondary containment required to minimise environmental damage should product be lost from primary containment. Product can be lost in a number of ways and the loss can be of varying amounts e.g. from a full release due to catastrophic tank failure to a drip from a valve seal. These are the 'hazards'. Each hazard has an associated probability taking into account the design of the tank, its associated equipment, maintenance systems, operating procedures, etc. The risk of environmental damage takes into account both the size of the hazard and the probability of it occurring. The 'defining hazard' is that which is identified as producing the greatest risk and it is this which drives the risk assessment. Thus, if small volume leakage or over-fill is the defining hazard then partial impermeable containment around the base of the tank shell or under equipment within the bund may be sufficient. However, if the defining hazard is considered to be full tank release, then a bund may need to be substantially impermeable to achieve acceptable environmental risk.

For new build installations the additional cost of installing substantially impermeable barriers within bunds may be small relative to the overall installation cost, because they can be incorporated in the overall design of the tanks, the piping and draining systems and the bunds themselves. Thus for new facilities regulators would expect bunds to be substantially impermeable.

For both primary and secondary containment, studies can be used to establish the most cost effective options. Such assessments may need to be iterative to review the impact of one or more measures installed on reducing potential environmental risk.

Consideration should be given to fire and explosion scenarios. The risk of a major accident resulting in loss of product containment should be reviewed. The possible need for temporary on-site containment of large volumes of potentially contaminated firewater should also be considered (see section *3.3.3.7*).

For new facilities the design brief should consider the roles of the workforce who operate, inspect and maintain the facilities. Human factors should be incorporated into the design so that the opportunities for human error are minimised. This should include the development of operating manuals as part of the design and construction process. They should be written to include practices which prevent or minimise spillage, loss or contamination and by so doing set a firm foundation for high environmental standards and performance at minimum cost to the operation.

At an early stage it is desirable to establish a dialogue with regulators on design proposals for new or significantly modified facilities.

3.2 LOCATION

Environmental factors at the location of the facility will have implications for its overall design, including the types of tanks installed, the materials used and the finishes and coatings of the tanks and plant to ensure primary containment and plant integrity are maintained. In addition, primary containment and equipment should be resistant to the contained products.

Factors to be considered are:

- Climatic conditions.
- Probability of very high wind speeds.
- Rainfall and snow loadings.
- Possibility of flooding.
- Likelihood of electric storms.
- Salt laden atmospheres in coastal environments.
- Level of groundwater (e.g. could the undersides of tank floors be wet).
- Underlying soils, geology and hydrogeology.
- Ground loading capability.
- Previous history of site.

3.3 ENGINEERING DESIGN

Concern for the operation of plant and equipment would not arise if it were possible to guarantee the integrity and reliability of the component parts of the installation. It is therefore essential to provide plant and equipment in such a way that the environment is protected in a practical and cost-effective manner.

At the design stage the engineer should consider enhancements to systems to improve long term integrity e.g. additional material corrosion allowances in vulnerable areas of storage tanks such as the floor and first shell strake, pre-coating the underside of new floor plates with bitumastic, etc. However, these measures should be assessed by reviewing their costs versus the benefits.

The design should also incorporate protection measures against damage to the plant or equipment which may occur, for example, through accidental external contact, over or under-pressure, corrosion, or erosion and take account of potential sources of explosion.

General guidance, particularly for new facilities, is available in Part 2 of the IP Model Code of Safe Practice *Design, construction and operation of petroleum distribution installations* [23].

3.3.1 Primary containment

All new equipment should be designed to the latest edition of recognised Standards and Codes of Practice e.g. for tanks: EN 14015[24], API 650[25].

A list of relevant international codes for storage and handling are given in the Storage BREF[3]. Examples of both good and bad practice for tank design are provided in CIRIA Publication C598[12].

Containment system selection and design should consider not only economic and technical aspects (including manufacture and installation) but also future operation, inspection and maintenance activities.

All equipment should be selected and provided to match the product being handled and the location/ climatic conditions to provide trouble-free and leak-tight service over the design life of the equipment when operated correctly. Factors that can cause primary containment failure include equipment damage, manufacturing faults, over-pressure, corrosion, erosion, fire (both internal and external) and explosion.

For new or retrofit designs, the practice of burying pipes and tanks should be avoided. New plant and equipment should be installed above ground as far as possible where it can be easily inspected and maintained. Below ground drainage systems should be designed to permit integrity testing.

Water should be prevented as far as possible from coming into contact with internal surfaces susceptible to corrosion. If alternative materials are not suitable on cost or technical grounds, then consideration should be given to coating vulnerable surfaces, or segregating such surfaces from contact with water by using a liner.

External surfaces should be protected against corrosion by an appropriate coating. Surface preparation is one of the keys to the long term performance of any coating.

Special care should be taken to minimise the ingress of water into pipe and tank insulation, as any corrosion will not be visible. It is important to consider whether insulation is actually required for a tank or component before specifying it. If air is allowed to circulate at the base and top of tank insulation, moisture is less likely to accumulate at these points. It is therefore good practice to design insulation that stops before it meets a tank base plate, pipe connection, valve or flange.

Proper account should be taken of temperature and pressure (resulting from the product, ambient temperature or solar radiation) by designing for expansion or pressure variations. Pipe work should be properly supported and suitably guided. Pressure relief should be provided in liquid lines where pressure can build up in closed systems. Pressure relief vent piping should be directed to contained systems.

3.3.2 Secondary containment

To allow for the possibility of equipment failure, operational error and accidents, it will be necessary to consider secondary containment measures. The design of these should be based on realistic failure scenarios.

The location of the site, its characteristics and the availability of reliable records or survey data will all play a part in selecting the final design of secondary containment.

Risk reduction is not only provided by physical means, such as a form of barrier, but also by the use of instrumentation, control systems and appropriate operating procedures. For instance, high level alarms should be installed to prevent overfill. High level alarms are safety devices and should not be used by operators to control the flow of product into a tank. Additional, and separate, level measurement should be installed for tank gauging purposes. The setting of the high level alarm should take account of the reaction time required to shut down the inlet flow. Linking the high level alarm to an automatic shut-off valve requires careful design as rapid closure against pumped flow can lead to problems of pipeline pressure surges. Particular importance should be given to the design of overfill protection where the feed pump for a tank is not controlled directly by the distribution installation e.g. where a tank is connected to an external pipeline with the pumps controlled by the supply refinery.

Examples of risk reduction measures in the form of instrumentation and control systems are:

- Provision of leak detection systems and volume reconciliation between supplied product and deliveries.
- Emergency shutdown and pump shutdown controls on critical elements of the operation.
- Installation of dry break couplings at points of loading or discharge.

Other examples of secondary containment include:

- Drip trays and pans beneath hoses and potentially leak prone plant and equipment e.g. hose couplings, valve glands, pump seals and interconnecting manifolds.
- Provision for the collection of slops and/or the separate collection of tank water bottoms in a sealed system.
- Closed sampling systems.

The Energy Institute risk assessment framework[21] can be used to establish the adequacy of storage tank secondary containment. This type of information will be required for the Safety Report and the Safety Management System at COMAH sites.

For tanks, bunds are required to contain lost product that can occur due to overfills and leakage from the shell of the tank or from components such as tank-side valves.

3.3.2.1 Tank bunds

A bund consists of a wall around the outside of a tank, or group of tanks, to contain any product loss for both environmental and safety reasons. The important safety reasons for a bund[13] are to:

- Prevent a flammable liquid from a tank spill or associated vapour reaching an ignition source.
- Minimise the surface area of the liquid and so reduce the size of any fire that may occur.
- Prevent the spread of burning liquids.
- Allow the controlled recovery or treatment of any spilled material.

For these reasons the materials of construction of the bund, including any sealant materials, should be capable of withstanding:

- Exposure to weather and atmospheric corrosion.
- Abrasion due, for example, to vehicular movement within the bund.
- The effects of a fire of the anticipated maximum duration and intensity, without collapsing or leaking.
- Contact with the product stored and fire-fighting materials.

A number of bunds at petroleum distribution installations are constructed of earth and clay. These may require a review to ensure that they are fit for purpose, including consideration of:

- Bund capacity.
- Bund wall construction.
- Design and operational arrangements for bund isolation.
- Management of drainage.
- Hazardous waste removal.

Bunds should be sized to have sufficient capacity to contain the largest predictable spillage. At existing sites the bund volume has been sized to accommodate either 100 % or 110 % of the contents of the largest tank in the bund[26, 13].

For new tank installations, the bund capacity should be:

- For single tanks : a minimum bund capacity of 110% of the capacity of the tank.
- For two or more tanks within the same bund the minimum bund capacity should be the greater of:
  - 110% of the capacity of the largest tank, or
  - 25% of the total capacity of all the tanks within the bund (except where tanks are hydraulically linked in which case they should be treated as a single tank)[12].

When estimating the bund capacity, the space occupied by the other tanks should be taken into consideration.

Concerning the degree of bund impermeability, the Storage BREF[3] states that the best available technique (BAT) for existing tanks is "apply a risk-based approach, considering the significance of risk from product spillage to the soil, to determine if and which barrier is best applicable. This risk-based approach can also be applied to determine if a partial impervious barrier in a tank bund is sufficient or if the whole bund needs to be equipped with an impervious barrier". The BREF outlines a risk-based approach involving the following steps:

1. Review spill volumes against spill frequency; this usually shows in relative terms higher chances of many very small spills compared with very low probability of larger spills.
2. Consider potential for infiltration of spill into the ground of the bund if it had no barrier - this is dependent on the product, ambient temperature, ground type, and time taken for emergency action to recover 'accessible' spilled product.
3. Combine steps (1) and (2) to give the probability for occurrence of different 'volumes' of contaminated land due to releases.
4. Consider the risks to receptors from the volume of contamination derived previously – examines fate and transport and this includes the potential for certain organic products to degrade under some conditions (note that groundwater is a receptor but, to aid the prioritisation of work, the risk to other receptors where groundwater is the pathway can be considered).
5. Repeat steps (2) through (4) for different barrier conditions.
6. Undertake sensitivity analyses allowing judgement of significance of risk for different barrier extent, product and ground type combinations as an aid to decision making.

A methodology developed for petroleum distribution installations by the Energy Institute[21] includes examples. The output from this methodology is expressed as:

- Current situation acceptable – no risk mitigation measures required.
- Further specific assessment required.
- Current situation not acceptable – risk mitigation measures required.

In the event that the framework suggests that the existing situation is not acceptable, a range of risk-mitigation measures should be considered. The evaluation process is iterative as additional risk reduction measures may justify the selection of a different defining hazard case e.g. a lower release volume due to leaks from tank fittings instead of from tank overfills.

Some mitigation measures act to reduce the likelihood of a release, such as:

- Ensuring suitable management systems are in place.
- Near-miss data review.
- Providing alarms and/or fail safe devices.
- Up-rating maintenance and monitoring procedures.
- Upgrading the tank, its fittings and/or pipe work.

These measures could be used to justify selecting a defining hazard case with lower likelihood.

Other measures act by preventing or reducing migration of products in the event of a release, including:

- Localised further secondary containment e.g. drip trays beneath pumps.
- Full or partial lining of the bund.
- Soil improvement to reduce permeability.
- Surface coatings to bund.

Cost effectiveness studies should be used with the findings from the risk assessment in an iterative evaluation process. Where findings, for example, show that over-filling is the defining hazard case, the alternatives for addressing this risk can be ranked on a cost-effectiveness basis.

For new build installations the methodology could be used to establish the design case. However, the additional cost of installing total or partial substantially impermeable barriers within bunds may be small relative to the overall installation cost, because they can be incorporated in the overall design of the tanks, the piping and draining systems and the bunds themselves. Moreover, the Storage BREF[3] states that BAT for new single walled tanks containing liquids that pose a risk for significant soil pollution or significant pollution of adjacent water courses is to apply an impervious barrier in the bund. Regulators will, therefore, expect to see new tanks designed with bunds which are substantially impermeable and can withstand the effects of a fire of the anticipated maximum duration and intensity without collapsing or leaking.

For existing tanks, the retrofitting of total bund liners is difficult because of problems of ensuring effective sealing around the existing pipe work and drainage structure. Moreover, there are likely to be additional safety and environmental hazards associated with retrofitting bund liners within an operating site.

Any liner system needs to accommodate tank settlements such that integrity is maintained throughout the operational lifetime of the tank. Tank settlements can be large over their lifetime (e.g. in excess of 1 metre for very large diameter floating roof tanks) especially where the foundation soils comprise soft estuarine silts and clays. The liner material should, in addition, be compatible with any product that may be stored in the facility.

Issues that need to be considered within the design and subsequent operation of liner systems include:

- Nature of the product.
- Effects of a fire within the bund or adjacent to it.
- Handling of any product when spilt in the sealed bund.
- Drainage of rain water captured in the bund.
- Potential damage to the liner from maintenance activities.
- Maintenance and testing of the liner.
- Repairing the liner after damage.
- Avoidance of lines passing through the bund wall.

3.3.2.2 Protection against tank bottom leakage

There is a potential risk of leakage from the bottom of a tank. Tank bottom leakage may be caused by corrosion or by deterioration of the tank foundations. For existing tanks, the main tools to mitigate the risk of tank bottom leakage are inspection and maintenance. These are considered in detail in Section 5.3.1.

Guidance on both tank inspection and maintenance and on the prevention of bottom leakage is provided in the Engineering Equipment And Materials Users Association (EEMUA) publications 159 and 183[27, 28].

For new build or relocated tanks, the use of Industry Standards and Codes of Practice in the design and construction of the tank and its foundation is essential. The combination of good design, proper construction and the appropriate level of inspection and maintenance can achieve acceptable risk levels.

When assessing foundation requirements it is necessary to consider both the physical properties and the corrosion characteristics of the ground. For example, the bearing capacity of the underlying soil affects the settlement potential of the tank. Account should be taken of the cyclic loading effects on the soil due to the tank being successively filled and emptied.

As with the surrounding bund, the need for a substantially impermeable barrier under the tank should be established using a risk-based approach. The Storage BREF[3] outlines a risk-based approach to emissions to soil below storage tanks developed in the Netherlands. This uses a scoring scheme for the combination of control measures implemented, including procedures and inspection regimes. The BREF recognises, however, that this scheme requires updating in light of improved installation, inspection and maintenance techniques. The EI publication *A risk-based framework for assessing bulk liquid storage facilities* [21] provides a risk-based methodology for determining the need for substantially impermeable under-tank barriers.

If the risk assessment process indicates the need for secondary under-tank containment for an existing tank, the options include the raising of the tank onto an impermeable foundation, the installation of an under-tank liner or the retrofitting of a double bottom to the tank. A potential advantage of the latter is that any product leak through the tank bottom into the space between the new and existing tank bottom can be detected. The main disadvantage, however, is the difficulty in safely repairing the bottom when a leak is detected as it is very difficult to gas-free and clean the space between the two bottoms. Consideration also needs to be given to changed tank design calculations for the stress at the shell/floor interface, location of fittings and possible corrosion from below of the original bottom which can negate the effectiveness of the vacuum leak detection system[3].

3.3.3 Control of aqueous effluents

It has to be recognised that some product may escape into the environment, despite rigorous operating procedures and mechanical integrity. Effective control of these releases is a second line of defence, after containment. Two principles apply if operators are to achieve effective control of aqueous effluent:

1. Release minimisation

— Operating equipment should be designed and maintained to keep spills to a minimum.
— The generation of waste water and product (e.g. from sampling or draining operations) should be kept to a minimum.

2. Segregation

— Clean, uncontaminated water (e.g. from roof drains on buildings) should, if possible, be discharged downstream of the oil-water separator. Clean water requires no treatment and would reduce the capacity of the separator to process the contaminated water it receives. Such segregated water streams should be initially sampled and tested, and periodically reviewed, to establish that they are not contaminated. They may, however, need an effluent discharge consent.
— Spills and leaked products, in particular those soluble in water, should be recovered, and reused or recycled if possible, to reduce the load on the separator.
— Wastes such as oily sludges and waste oils should be collected for disposal, reuse or recycling. Such wastes should not be disposed of down drains.

To understand how these two control principles are applied it is necessary to consider the various operations carried out in a distribution installation as set out below.

3.3.3.1 Loading racks

Tanker loading can be a source of petroleum product release at an installation. Some of the ways in which this can be avoided are:

— Installation of roof canopies over road loading racks to minimise rainfall coming in contact with product (e.g. from drips). The roof is able to direct rain water through drains to uncontaminated discharges.
— Bottom loading will reduce the number of drips to the surface compared to top loading operations.
— The loading rack area should be surfaced with an oil-resistant substantially impermeable material.
— Spills or drips can be contained within the loading rack area through the use of kerbing or grading the loading rack slab to strip drains connected to the oil-water separator. The design should be capable of coping with the largest foreseen spill and preventing product flowing from one loading position to the next.
— Grading the external hard-standing down and away from the road loading rack slab to divert clean rainwater away from the loading rack.
— Clearly signposted emergency shutdown (ESD) buttons should be located on the rack so as to allow the rapid closure of the loading system and so minimise the quantity of a spillage should a failure occur.

3.3.3.2 Hose connections

There may be a very small amount of drips when disconnecting hoses, even where dry break couplings are installed.

The following should be considered:

— Drip pans under the hose connections. Consideration should be given to draining these directly to collection tanks which offer the advantage of product recovery (particularly when these drains are covered when not in use). However, an assessment of the risk of creating a fire hazard should be made.
— Kerbing around unloading areas will contain spills and direct them to the oil-water separator.

3.3.3.3 Yards and operational areas

To control product spills in operational areas:

— A risk assessment should be undertaken to establish if substantially impermeable surfacing should be laid. Where concrete is used, an oil-resistant sealant should be laid in all joints.
— Drainage from yards should be to the oil-water separator.
— To isolate areas in the event of a spill, drainage

systems may be fitted with shut-off valves.

- Operational equipment, such as pumps, should be within kerbed, substantially impermeable spill containment areas which can be drained to the oil-water separator under controlled conditions.
- Absorbent work pads can be used to prevent petroleum product from contaminating the soil in areas where spillage from equipment during maintenance is likely to occur. Used pads should be placed in sealed bags, labelled as contaminated waste and disposed of in the appropriate manner.

3.3.3.4 Road tanker maintenance and wash bays

The waste oils from truck maintenance bays tend to be contaminated with cleaning chemicals which emulsify oil products and should **not** be directed to the oil-water separator.

- These wastes should be collected and treated separately from other plant wastes using recycling or other off-site disposal facilities.
- Used antifreeze, cleaning solvents and used oil should be collected and disposed of in an appropriate manner.
- Where floor cleaners are used these should be biodegradable, kept to a minimum and directed to the foul sewer.
- Surface drainage from this area should be to the foul sewer, or to a sump for subsequent pump out and disposal off-site.
- Truck wash water should be isolated from other effluent and discharged into the foul sewer if permissible and feasible (see section *3.3.4.4*).
- Alternatively, truck wash water should be treated on-site and recycled. This is the preferred option for new installations.

3.3.3.5 Tanks

Storm water

Storm water in substantially impermeable bunded areas should drain to a sump or more preferably to a low point in the bunded area. This water should be removed from the bund for treatment in the oil-water separator under controlled conditions to prevent exceeding the capacity of the treatment system. If water collected in bunds is not fed to an oil-water separator, it should be tested to ensure compliance with consent before discharge. If contaminated, it may need to be disposed of off-site.

Tank water draw-off

Alcohols or ethers used as gasoline components will dissolve into water bottoms. In these cases it is important to minimise water bottoms. Operators should not feed water bottoms containing dissolved alcohols or ethers into the oil-water separators and will need to arrange off-site disposal.

In other cases, the water drained from tanks may be contaminated with petroleum product and other hydrocarbons and can have a high biochemical oxygen demand (BOD) and solids level. Suggestions for control include:

- Free water in the product should be minimised in all product receipts.
- Fixed roof tanks will minimise the risk of storm water mixing with stored fuel. Where external floating roofs are installed, secondary seals and roof drain hoses should ensure storm water is unable to mix with the product in storage. Geodesic domes are a further, but very expensive, option which can be considered if snow loading is a problem.
- Reduce the frequency of tank water draining to the lowest effective level to reduce the volume of product loss.
- Install hold-open valves or automatic sensing valves to reduce the risk of accidental product release.
- Route all tank water drainage to a central tank or to drum storage for further separation and product recovery.

3.3.3.6 Pipeline receipt and pumping facilities

Pipeline facilities can offer a high standard of environmental protection since the product is fully contained at all times (i.e. it is not loaded into ships, road or rail tankers, etc.). However, there are some special considerations for pipeline operations. Firstly, long pipe runs or buried pipes may corrode and/or leak without detection for a considerable time. Secondly, for some pipelines, responsibility may extend well beyond the plant boundaries. It is important in this case that a single custodian, or focal point, is identified who is responsible for:

- The overall accountability for setting up and maintaining a system of pipeline/plant integrity management.
- Providing a hierarchy of means and authorities to stop all operations in the event of an incident.

These aspects should fit closely into the contingency plans produced for the installation and are particularly important where the pipeline is a multi-user operation. Successful integrity management for pipelines would incorporate the following:

— Effective leak detection system.
— Schedules of inspection and maintenance.
— Up-to-date and accessible documentation and drawings including topography and all related features.
— Incident and emergency response plans.
— First aid tools for spills, pollution control equipment and a means to get them to a spill that may be remote from the plant installation.

Where underground pipelines are installed within the petroleum distribution installation, an underground line integrity management programme should be implemented which, through a combination of inspection and testing, ensures the integrity of the lines. Further guidance on underground lines is provided in the Scottish Executive publication[14].

3.3.3.7 Emergency containment

Consideration should be given to containment and control in the event of an emergency or incident to minimise the risk of environmental pollution.

Such incidents may involve a major spillage or leak from part of the installation, a tank fire requiring the use of large quantities of water and/or fire-fighting foam, or a combination of these events resulting in the risk of a bund overflow.

There will be a risk of exceeding consent limits for effluent discharge if the normal drainage systems are used without control. If normal drainage systems are used for disposal there may be a need to have storage, a means of stopping flow and the effluent tested prior to discharge.

In preparation for these events a pollution incident response plan (PIRP) is required. This should cover contingency planning, the provision of suitable equipment (including that to prevent discharge to the environment) and the selection of appropriate foam for fire-fighting. Equipment provision should include, for example:

— Absorbent materials.
— Dams or booms for blocking on land or water.
— Protective clothing.
— Disposal materials such as sacks, bags, shovels, bins, etc.
— Hoses and pumps suitable for hazardous area use (perhaps using a hydraulic/pneumatic power pack).

Guidance should be available on site for procuring larger plant such as vacuum tankers, excavators, larger pumps etc., suitable for use in hazardous areas.

Contingency plans may include a requirement for containment systems where potentially polluting effluents could be retained prior to disposal, either off-site or via the drainage systems. A risk assessment should be undertaken to determine the appropriate level of containment, taking into account the potential risks to pollution of soil and ground and surface waters. This depends on the local circumstances, such as which products are stored, the risks posed by accidents or fire, the sensitivity of the receiving environment and the importance of preventing any discharge to it. Guidance is provided in the HSE Publication EH 70 *The control of fire-water run-off from CIMAH sites to prevent environmental damage* [30].

The Storage BREF[3] for IPPC regulated sites states that the capacity for containing contaminated firewater depends on local circumstances, and has to be decided on a case-by-case basis using risk assessment. The BREF provides guidance on the general best available technique (BAT) levels for a new facility. For toxic, carcinogenic or other hazardous substances, BAT is deemed to be the application of full containment. However, it is recognised that both technical and economic considerations must be taken into account on a site specific basis.

To size any containment system, knowledge of the anticipated quantity of firewater run-off is required and although this cannot be calculated with any precision it should be estimated. Both water from sprinkler or deluge systems and that applied by fire-fighters must be considered. Some guidance is provided in CIRIA Report 164 [29].

Requirements to contain firewater run-off will be much easier to meet at new petroleum distribution installations than at existing ones as they can be allowed for at the conceptual design stage. At existing sites, it may be possible to use adjacent bunds or tank compounds not involved directly in the incident.

Where permanent containment facilities are impracticable because of cost or space constraints, then temporary containment systems should be considered. In such cases, consideration of some other form of local containment may be necessary to provide sufficient time for temporary systems to be prepared.

One option to reduce the volume of potentially contaminated water is to reuse the water to tackle the fire. This requires prior discussion with the Fire Authority to determine any restrictions and whether there is a need for any special equipment. It may also be necessary to arrange for this water to be monitored for its suitability. This should be detailed in the site emergency plan.

The disposal of fire-fighting foam should take into account that foam can emulsify hydrocarbons which renders any gravity separation treatment ineffective, and that the foam-producing chemicals themselves may be potentially harmful if released in an uncontrolled manner.

Further guidance on the containment and control of petroleum products and fire-fighting fluids in an emergency is provided in Part 19 of the Institute of Petroleum's Model Code of Safe Practice *Fire precautions at petroleum refineries and bulk storage installations* [31] and in the Pollution Prevention Guideline PPG18 [32].

3.3.4 Treatment of aqueous effluents

3.3.4.1 Introduction

The various aqueous effluent streams identified in the previous section are required to be treated to meet environmental standards before disposal to watercourse or sewer. In the case of effluent from petroleum distribution installations, the most common treatment will be by gravity separation in oil-water separators.

Previous sections have highlighted the importance of reducing the volume of waste water streams in order to minimise the load on the oil-water separators. As well as separating oil and water by gravity under continuous flow conditions, separators have an additional important function as a holding device with sufficient volume to retain or intercept a product spillage and prevent it leaving the site (hence their traditional name of 'interceptor').

The selection and design of treating facilities is strongly influenced by the type of effluent being treated and also by the means of disposal of the effluent streams from the site.

Normally, foul and trade effluent streams are routed directly into the public sewerage system, (possibly after preliminary site treatment, e.g. removal of solids), for treatment by the local sewage treatment provider. Surface water contaminated with oil will normally be treated on site in an oil-water separator and may be discharged either directly into controlled waters or the public foul sewage system. Both of these disposal routes will require a consent to discharge.

The site should have a site drainage plan. This should be a clear diagram showing the layout and access details, along with a schematic representation of the site drainage arrangements. It is good practice to colour code the different drainage systems on the plan. The colour coding is usually red for foul sewers and blue for surface water drainage. The direction of flow should be clearly indicated on the plan. The same colour scheme can be used for the drain covers on-site; these can also be numbered to assist identification. Guidance on site plans is provided in the Pollution Prevention Guideline PPG 21 [22].

Care should be taken to ensure that waste water streams within the site are properly segregated to avoid any cross-contamination which would affect the operation of the on-site treatment facilities. In all cases drainage pipes, and in particular the seals joining the sections, should be designed for long term integrity.

3.3.4.2 Treatment of contaminated surface water

Petroleum distribution installations will generate water contaminated with traces of petroleum product from sources such as operating areas, loading racks and tank bottoms. It is normal practice for it to be routed via secure drainage into a separator or separators.

3.3.4.3 Treatment of uncontaminated surface water

Uncontaminated water e.g. rainwater run-off from clean paved areas, buildings and other structures which will not receive spillage or leakage, should not be fed to the oil-water separator. Consideration should be given to the installation of sustainable drainage systems (SUDS) which mimic the natural drainage of fields and wetlands. An introduction to the techniques available is provided in references[33] and [34].

Before any aqueous stream is classified as 'clean' it should be sampled and tested. Such sampling may need to be periodically undertaken, depending on changes to site operations, etc., to establish that they continue to be uncontaminated. They may, however, need an effluent discharge consent. The risk of contamination from emergency incidents should also be considered (see section *3.3.3.7*).

3.3.4.4 Treatment of trade effluent

The most common type of trade effluent found on a distribution installation is the waste water from vehicle washes. This water should not be allowed to enter any surface water sewer or oil-water separator, as the wash detergent can emulsify any oil in the separator and destroy its effectiveness. All cleaning and washing operations should be carried out in designated areas isolated from the surface water or oil-water separator drainage systems. The area should be clearly marked and a kerb surround or 'roll-over' bund installed[35]. This trade effluent should be routed to the public foul sewer system. It may require pre-treatment to meet the local sewerage utility discharge consent. If a foul sewer is not available to dispose of trade effluent, a holding tank can be provided for subsequent disposal off-site. Alternatively, for new installations, recirculation systems can be used, but even with these it is still necessary to dispose of small volumes of effluent.

3.3.4.5 Oil-water separators

General

In normal circumstances, contaminated water streams from petroleum distribution installations can be satisfactorily treated using primary treatment systems. However, in particularly sensitive environments, secondary or tertiary systems may need to be considered. The differences between the systems are:

— Primary systems use the principle of gravity separation to separate the lighter undissolved hydrocarbons from the water.
— Secondary systems could involve flocculation, coalescing filter, etc.
— Tertiary systems have biological treatment to remove dissolved hydrocarbons.

Alternatively, sustainable treatment systems, such as constructed wetlands, can reduce residual pollutants from primary systems. Wetlands are ponds that are specifically designed to encourage a wide variety of wetland vegetation. In addition to removing a range of pollutants, they can provide excellent wildlife habitats. A disadvantage is the space required, but this can be overcome by the use of linear designs or modular systems[34].

Careful attention should be given to the design of separators[36]. In particular the flow of water through the separator, which affects the residence time, is most important. Many sites have expanded during their operating life and as a result the flow through the separator may have increased, thus reducing the residence time and hence the efficiency of the separator.

Any failure of consent should be investigated and actions taken to address the cause and bring the discharge back within consent compliance. In drawing up any programme to address consent failure the first step should be to examine if the maximum benefit is being gained from the containment and segregation procedures already in place before investing in additional hardware. Building additional separation capacity is often the least cost-effective route to better water quality. However, if the existing facilities are operating at maximum efficiency and consent failure still occurs, then additional primary capacity or further more effective treatment systems should be considered.

Oil-water separators rely on the principle of gravity separation. Droplets of hydrocarbons in suspension with water and of a lower density tend to rise to the surface. The efficiency of separation increases with residence time and decreases with turbulence. In the past, three chamber interceptors with trapping bends have been installed at smaller facilities – see Figure A.2.1, Annex B. This type of separator is adequate only for small water flows due to the need to obtain minimum turbulence and maximise residence times. It is not recommended, therefore, for new installations.

On larger distribution installations, the API (American Petroleum Institute) design separator is often used – see Figure A.2.2, Annex B.

More recently the tilted plate separator has been adopted – see Figure A.2.3, Annex B. This is based on a laminar flow principle, whereby contaminated water flows through a large number of closely spaced plates which are tilted along the longitudinal axis, typically at 45 degrees. This type of design reduces turbulence and effectively increases the residence time.

Design considerations

For surface water separators the basic design consideration is an estimate of the water flow through the separator. Before the separator can be designed it is necessary to examine the layout of the facility to decide which areas have uncontrolled drainage and those that can be controlled.

Uncontrolled areas include loading yards, roadways, paved areas and roofs, etc. Rainfall on these areas can reach the separator via the drainage system very quickly. Although it is possible to restrict the inlet to the separator this may be at the expense of some flooding in the site under storm conditions.

Controlled areas are tank bunds and other bunded areas. Here the rain water can be held back until the separator can deal with it. Run-off is then controlled by the operating staff.

Where the water collects on unpaved areas (typically grass or gravel), an estimate should be made of what percentage of the water will soak into the ground rather than run off.

The drainage system from controlled and uncontrolled areas should be designed to handle the foreseen worst condition rainfall. This will vary considerably from location to location and a decision needs to be made on what constitutes a 'reasonable' design basis. In the UK, for instance, the basis is often taken as the rainfall in one hour during a once in 10 year severity storm. Guidance is provided in the Pollution Prevention Guideline PPG3[37].

For separators dealing with surface water drainage, systems should be designed so that the rate of flow to the separator is slightly restricted, but the inlet valve can also be used for this purpose under rainfall conditions which are well in excess of the design. Since these conditions can occur at any time (including when the site is unmanned) it is usual, except where the receiving waters are highly sensitive, to incorporate a storm by-pass into the separator design. The view is usually taken that the initial rainfall will flush down any residual oil which the separator can deal with and after that the excess rain water will be clean and can by-pass the separator.

When designing a new installation, some allowance should be considered for future expansion. In order to minimise turbulence and to maximise oil particle size, it is preferable to rely on gravity flow to the interceptor. Where this is not possible, care should be taken in the correct selection of the pump and a positive displacement type is recommended. Ideally any pumping system should be installed after the separator rather than before it.

3.3.4.6 Sampling

Facilities should be provided for sampling of effluents discharged from the installation and it is recommended that a dedicated sampling chamber is installed after the separator.

3.4 SUMMARY

When designing the facility, emphasis should be placed on hazard prevention rather than risk management.

The design of an installation should ensure that primary containment integrity is maintained in the long term.

Risk assessment, with a subsequent cost effectiveness study, will determine the appropriate secondary containment required.

The combination of good design, proper construction and the appropriate level of inspection and maintenance can achieve acceptable risk levels.

Minimise the amount of contaminated water flowing to oil-water separators.

Where possible, segregate clean from contaminated water.

Install proper sampling points to ensure that the samples of aqueous effluent are representative.

4

CONSTRUCTION AND COMMISSIONING

4.1 INTRODUCTION

Failure to consider potential environmental risks during both the design and construction phases could ultimately result in a loss of containment integrity. Designers should consider the pollution risks in these phases and ensure they are minimised. Operators and contractors should ensure that the construction does not cause pollution through loss of fuel from machinery or bowsers and that ground disturbance does not mobilise pollutants that may possibly be present in the soil.

When constructing new tanks, regulators will expect substantially impermeable secondary containment to be provided. New pipe runs should be above ground or in pipe trenches to allow inspection and repair as necessary.

4.2 CONSTRUCTION

The best designs and procedures can be of no consequence if the subsequent construction works are not undertaken in the appropriate manner. The principles of *The Construction (Design and Management) Regulations* (CDM)[38] should be applied throughout. Good quality construction is essential. It should be undertaken only by suitably experienced and appropriately qualified personnel. The quality of all materials and equipment should be checked prior to their installation or use. Strict quality control should be undertaken during construction or installation. Rigorous inspection and checking of completed systems is essential.

The petroleum distribution installation records should be updated on completion of any works. For a new tank a build record should be produced containing all relevant data including design calculations. This is also a requirement of EN 14015[24].

4.3 INTEGRITY TESTING

Integrity testing should always be undertaken on-site after the installation or construction of equipment. Relying on factory testing of components is not adequate as this will usually not include pipe work and connections.

Test procedures should, where possible, include:

- Undertaking a risk assessment before any integrity testing.
- Testing and putting into operation all relevant safety systems, alarms, etc., before integrity tests are undertaken.
- Integrity testing of systems to the maximum operating design pressure.
- Testing of re-used or refurbished components prior to commissioning.
- Testing of all valves for correct operation.
- Testing of all instrumentation, monitoring and safety devices before commissioning.

Contractors should employ qualified inspectors to test welds using non-destructive testing (NDT) techniques in accordance with equipment specification and approved procedures. Certificates of successful testing should be provided to the facility owner/operator. It is important to keep, and have readily available, records of all test and inspection work undertaken.

Where storage tanks and/or bunds are tested hydrostatically, the disposal route for the water used should be established prior to the test. If water is drained to the site oil-water separator, it is important that it is not overloaded. The operation of all instrumentation and alarms should be proven during the hydrostatic test. Guidance on hydrostatic testing is given in CIRIA Publication C598[12].

4.4 COMMISSIONING

A commissioning procedure document should be prepared which systematically sets out the commissioning operations. The procedures should always be in accordance with the specification of the equipment, manufacturer's guidelines and the most up-to-date guidance.

Prior to commissioning, the contractor/facility operator should have undertaken all integrity testing. The system and all of its components should be adequately labelled. A full inspection by facility owner/operator and the building contractor should be undertaken to ensure that all works and testing have been completed and that all equipment is safe.

As system faults are most likely to occur during commissioning, close monitoring and checking of the equipment should be undertaken during this phase.

4.5 SUMMARY

Good quality construction, undertaken only by suitably experienced and appropriately qualified personnel, is essential.

Integrity testing should be undertaken to the satisfaction of the client on-site after the installation or construction of equipment.

A commissioning procedure document should be prepared which systematically sets out the commissioning operations.

5

OPERATION

5.1 OPERATIONAL ACTIVITIES WHICH POSE A RISK TO THE ENVIRONMENT

Operating a distribution installation always carries an environmental risk. Product loss can occur not just from storage but also from the pipe work, pumps and other equipment and also during loading and off-loading operations.

The release of product, for example, can occur during any of the following activities:

— Filling and emptying of storage tanks.
— Product loading.
— Sampling.
— Water draw-off and draining.
— Maintenance and repair.
— Tank cleaning.

Good environmental performance depends largely on good operating procedures and practices.

Emphasis is placed in this Chapter on liquid releases, seen as the major environmental risk, but the handling of solid wastes and sludges is also addressed.

A new installation requires written operating procedures and the staff will need training before it commences operation. Examination of the operating procedures and experience from an existing, well established installation will help when compiling instructions for a new plant. At existing installations, new procedures should be developed following modifications and improvements. It should be remembered that where work is covered by Work Permit procedures these should make proper allowance for environmental issues.

Operating procedures should exhibit the following features to ensure success in all aspects of the site operations, especially in environmental performance:

— Simplicity.
— Minimum risk of misunderstanding or confusion.
— Maximum safety, integrity and security.
— Recognition of, and provision for, inspection and testing of plant and equipment.
— Clear guidance on standards and practice expected for:
  a) housekeeping;
  b) isolation or spading of pipe work;
  c) loss control, including recognition of the potential for, and sources of, leakage, with guidance on possible containment and treatment;
  d) draining of equipment and pipe work;
  e) re-instatement of equipment;
  f) maintenance to preserve containment integrity.
— Clearly define individual responsibilities.

In all cases procedures should be in place to deal with any spillage during operational activities. Emergency response plans (see Section 2.2.4) should be in place to deal with any larger loss of product.

5.1.1 Filling of tanks

There is a risk of tanks being overfilled resulting in product loss into the bund. This should be addressed by:

- Knowledge of ullage space available and volume of product being received before tank filling commences.
- Clear procedures for ensuring that product is pumped to the correct tank, particularly where tanks are interconnected or manifolded together.
- Setting high level alarms to ensure adequate time after alarm activation to shut down product flow before an overfill occurs.
- Regular monitoring of product level during tank filling.
- Prompt action to stop product flow if high level alarm is activated.
- Not permitting the high level alarm to be over-ridden.
- Maintenance of:
  a) level gauging systems;
  b) high level alarms.

5.1.2 Product loading

Spillage can occur during the loading of road tankers due to leakage from loading arm or hose connectors and from overfilling of tanker compartments. These should be addressed by:

- Written procedures for both top and bottom loading.
- Adequate training and regular assessment of all loading personnel.
- Maintenance of:
  a) couplings and connectors (on both tanker and loading arm/hose);
  b) high level cut-off systems (on both tanker and loading gantry).

5.1.3 Sampling

Care should be taken when sampling product from tanks to reduce drips and spills. To achieve this operators can:

- Minimise the frequency and volume of sampling.
- Return product samples to stock, not poured down the drain or onto the ground.
- Have a closed system of piping for sampling.
- Maintain hold-open sampling valves to prevent drips.

5.1.4 Water draw-off and draining

Draining of lines and tanks can result in product being lost to the drainage system. This should be addressed by:

- Minimising the frequency of tank water draw-offs.
- Attendance during manual draining to prevent accidental drainage of product.
- Maintenance of:
  a) drain valves to prevent drips;
  b) automatic sensing valves where fitted.
- Ensuring caps are fitted to irregularly used drain lines.

5.1.5 Maintenance and repair

Loss of product can occur during maintenance if lines or equipment have not been correctly isolated and drained. An appropriate Work Permit system can minimise environmental risk. Factors to address are:

- Ensure equipment is empty prior to maintenance.
- Avoidance of accidental damage to surrounding systems.
- Monitoring of repairs to ensure that they are completed fully and correctly.
- Proper disposal of waste.
- Proper commissioning procedures.

5.1.6 Tank cleaning

During tank cleaning, water is introduced into a tank to flush out petroleum products, sludges and solids. The potential problems from this contaminated water can be minimised by:

- Removing as much hydrocarbon as possible from the tank prior to cleaning.
- Using the minimum amount of water to flush out the bottom sludge.
- Separating the cleaning water and disposing off-site.

It is important that, before tank cleaning, all sludges should be evaluated e.g. for toxicity. If the sludge is found to be toxic or have hazardous properties, a specialist contractor should be employed to clean out the tank and dispose of the contents.

For further information on tank cleaning see Part 16 of the IP Model Code of Safe Practice, *Tank cleaning safety code* [39].

5.2 ROUTINE ACTIVITIES TO REDUCE ENVIRONMENTAL RISK

The following list gives an example of the nature and frequency of routine activities that may be undertaken to reduce environmental risk. Each site should develop their own list of such activities based on individual circumstances. It is important that constant vigilance is maintained to ensure that leaks and spills do not go unnoticed. Recorded inventory checks can identify prolonged small leakage from storage (see section 5.4).

5.2.1 Daily

- Walk round the site, identify and clear up any waste materials.
- Note signs of any deterioration of tanks or surroundings.
- Note any small leaks or spills, fix them and clean them up immediately.
- Check the separator(s) to ensure they are operating correctly.
- Inspect the tank bund valves to ensure they are closed.
- Remove any excess water from tank bunds (and other compounds) in accordance with the agreed procedures at the site.
- Check drip trays and pans.

5.2.2 Weekly

- Remove any surface oil in the separator.
- Check that drain covers/grids are clear of debris.
- Examine stock records of all tanks to detect any early signs of leaks.

5.2.3 Monthly

Sample outflow from separators and analyse to check for compliance.

5.2.4 After rain

- Check external floating roofs and drain off accumulated water.
- Draw off water from external floating roof tanks if required.
- Check tank bunds and remove any excess water in accordance with the agreed procedures at the site.

The oil-water separator should be inspected regularly. Arrange for accumulated silt to be removed when required, ensuring that the separator is refilled with water.

5.3 INSPECTION AND MAINTENANCE

Containment integrity does not simply rely upon the design and provision of good quality, fit for the purpose, plant and equipment which is operated correctly. It is at least equally reliant on the manner in which it is maintained and the basic principle of cost-effective maintenance is rigorous inspection.

The inspection regime begins with visual inspection of plant and equipment on a regular basis. This is linked with the discipline of frequent stock reconciliation of product volumes to provide early warning of significant problems (see section 5.4.1).

Inspection activity includes the testing of essential monitoring and protective equipment such as emergency shutdown (ESD) systems, cathodic protection equipment, leak detection systems, level gauges, relief valves, high level alarms, spill equipment, etc.

Specialist resources may be necessary to provide the appropriate expertise for inspection interpretation and maintenance tasks. Examples where this is likely are:

- External/internal coating check.
- Pressure testing.
- Tank shell and floor thickness/defect checking.
- Intelligent pig internal pipeline checks.

Inspection and maintenance will be most efficient and effective if performed to a schedule. It is important to keep, and have readily available, a written overview of changes, repairs and incidents along with records of all maintenance and inspection work undertaken.

It is obvious that plant which is inaccessible is the most difficult to inspect. Examples include tank or pipe internals, any underground tanks or pipework or equipment which is difficult to release from service for inspection and maintenance. Operational management should be prepared to release equipment for inspection in accordance with programmed inspection/maintenance dates. There should be no excuses for not doing so if the owners of the integrity inspection and maintenance system publish schedules, which have been discussed and agreed with operating staff, on a timely and regular basis.

All maintenance should be undertaken to minimise the possibility of future failure.

5.3.1 Storage tanks

The primary operational tool against loss of tank integrity is effective inspection and maintenance, and this is key to reducing the environmental risk from leakage. All tanks should be inspected in accordance with the latest Industry guidance. A written record of all inspection and maintenance work undertaken should be kept and be readily accessible.

Typically a tank is designed and operated so that it can remain in service for many years without the need for it to be emptied for internal inspection. The external tank structure, surrounds and associated equipment should be inspected more frequently.

A total inspection scheme should include:

- Observations made by site operators during routine duties.
- Scheduled in-service inspection examinations made by an inspection engineer (including ancillary fittings and alarms) on an approximately annual frequency.
- An out-of service inspection when the tank is gas freed and cleaned for internal inspection and maintenance. This has traditionally been undertaken at fixed intervals, but consideration should be given to a risk-based inspection frequency as detailed in EEMUA Publication 159[27].

These parts of the total inspection scheme are outlined in more detail below.

5.3.1.1 Operator observations

Staff should be alert to any sign of deterioration or change to a tank or its surrounds, especially of leakage or signs of over- or under-pressurisation. A system should be in place for the operators to record these observations and to communicate them to the tank inspection engineer.

5.3.1.2 In-service inspection

External visual examination of every tank and its surroundings should be made at regular intervals. EEMUA Publication 159[27] provides guidance on the frequency of this inspection. During the inspection both the tank and ancillary equipment should be examined to detect any signs of deterioration or change since the previous inspection. Potential problems can thus be identified and maintenance work can be carried out before any serious faults develop. The inspection should include an examination of the bund and all equipment enclosed within it. The inspection should use a standard checklist (e.g. as provided in reference[27]) to ensure that all features are examined. Following this inspection, further more detailed in-service testing (e.g. ultrasonic thickness gauging of the tank shell or roof) may be considered necessary.

5.3.1.3 Out-of-service inspection

An out-of-service inspection is the main way of confirming that a tank is fit for service for a projected period of time. It allows the condition of the tank to be assessed, measuring how it has performed under service conditions since the last out-of-service inspection. It allows the identification of any work required to bring the tank back to good condition. It also allows the prediction of the length of time the tank can remain in service before another major shut-down is required.

Inspection of the interior shell and roof allows for better detection of local deterioration than the in-service external examination.

The out-of-service inspection is the only time that the floor of the tank can be physically examined. A visual examination can be supplemented by floor scanning using a magnetic flux core leakage (MFL) or ultrasonic device. Both of these will give information on the underside of the floor.

The inspection should use a standard checklist to ensure that all features are examined. The observations made and the conclusions reached during an out-of-service inspection should be accurately recorded.

5.3.1.4 Probabilistic preventive maintenance (PPM)

The application of risk- and reliability-based techniques for optimising inspection and maintenance activities is provided in detail in EEMUA Publication 159[27]. The PPM approach is based on two existing underlying methodologies – risk-based inspection (RBI) and reliability-centred maintenance (RCM).

RBI is a process for ensuring that the integrity of equipment is properly addressed whilst improving availability. It replaces time-based inspections with flexible inspection programmes. This is achieved by employing risk assessments based on operational, design, materials and environmental considerations.

RCM is a process for determining, in a cost-effective manner, the optimum maintenance requirements of the tank and ancillary equipment. Integration of these methodologies provides for the:

- Development of a preventive maintenance plan.
- Setting up of an inspection plan.
- Development of testing schedules.

The introduction of PPM should be assessed by reviewing the costs versus the benefits. PPM costs time and money e.g. due to the introduction of more costly inspection techniques such as floor scan and acoustic emissions. However, there are major benefits of the PPM approach such as:

- The potential for an increased inspection interval.
- Reduction of the risk of 'unwanted events' such as bottom leakage.
- Better understanding of the integrity of all storage assets.

5.3.2 Bunds

Inspection and repair of bunds should be carried out on a regular basis and the results recorded. For example, cracks in concrete, failure of flexible seals around pipes as they pass through bund structures and animal damage to earth bunds can all compromise the integrity of secondary containment systems. Instruction signs should be maintained and essential equipment, such as valve keys, should be checked to ensure they are in place.

5.4 LEAK DETECTION

There are a number of different techniques that can be used to detect leaks from storage tanks mounted on or below ground. The need to detect a leak as soon as possible to reduce the potential for pollution should be considered in the choice of any detection method applied.

Leaks from above ground tanks (e.g. horizontal tanks mounted on saddles) and above ground pipework can be detected visually.

Where underground pipelines are installed, an underground line integrity management programme should be implemented which, through a combination of inspection and testing, ensures the integrity of the lines.

5.4.1 Inventory checks

These checks are based on:

- The level of the product in the tank (level check), or
- The mass of the product in the tank under static conditions (mass check), or
- The difference between the volumes pumped in and out of the tank over long periods compared to the change in stored volume.

The first two checks are known as static volumetric methods and require the tank to be out of service for one to two days. The third method, known as the enhanced inventory check does not affect the operation of the tank. It requires accurate measurements of the inlet and outlet flows. Where vapour recovery is in operation at the site, the volume of product recovered and returned to storage should be accounted for.

Alternatively, leaks can be detected through the use of statistical inventory reconciliation (SIR). In this technique a statistical model of the normal operating pattern of a tank is established. A leak introduces a change in daily variance which can be used to initiate an alarm.

5.4.2 Barrier systems

Where a substantially impermeable membrane is installed under a tank, any leak from the tank floor can be led to the perimeter of the tank. Regular inspections can be made for the presence of product at the 'tell tale' leak detection point.

Where a double bottom has been installed, the space between the bottoms can be held under vacuum. Any leak will dissipate the vacuum and trigger an alarm. However, corrosion from below of the original bottom can cause spurious alarms due to loss of vacuum.

Alternatively a detection cable can be placed below the tank bottom (or in the interstitial space between tank double bottoms). The electrical properties of the cable change when it is in contact with hydrocarbons and this can be used to indicate a potential leak.

5.4.3 Soil vapour monitoring

This method depends on the testing of vapours which either diffuse into shallow bore holes or are drawn with a vacuum pump connected to permeable tubing from the soil around or below a tank. The number of sampling points required depends on the tank diameter and soil permeability. A survey of the soil should be undertaken before any leak occurs to ascertain if any background emissions are detected. The basic method is only applicable for volatile products. For other products, a marker can be added to the stored product to improve the detection capability. This method only works once a leak has occurred. There will be a need, therefore, to consult with the local environmental regulator before employing this technique.

5.5 OPERATION AND MAINTENANCE OF OIL-WATER SEPARATORS

Once installed, the efficiency of the separator (see Section *3.3.4.5*) should be maintained by proper inspection, operation and maintenance. In particular, oil reaching the separator should be removed frequently as failure to do so may result in the oil being re-entrained in the water under high flow conditions. Depending on the type of separator, various equipment can be installed to remove the oil. In the three chamber separator, it is normally a manual operation using ladles, temporary suction pumps or oil absorbent mops. In the case of the API or tilted plate separator, floating weirs with pumps or skimmers can be installed with separate settling tanks. Oil removed should be recycled or properly disposed of.

Solids should not be allowed to build up in the separator since this can reduce the effective residence time of water in the separator. Due to the increased flow rates oily particles can flow through, with consequent reduction of the efficiency. Solids and sludges removed should be properly disposed of.

In addition to the regular removal of solids and sludge to maintain optimum residence time the walls of the separator should be cleaned of oil from time to time. The deposition of oil can be minimised by maintaining a constant liquid level and by fitting tiles or stainless steel liners to the walls.

Separators can be fitted with automatic closure of the outlet valve, triggered when the level of oil builds up in the separator, for example after a spillage. The automatic closure device relies on the density difference between oil and water. It can be a simple mechanical device, or can activate an electrically controlled valve. These devices should be tested and maintained according to manufacturers' recommendations. In addition, a non-return valve is sometimes fitted on the outlet of a separator where it is liable to flooding, for example in a tidal situation.

In an installation where the separator is some distance from the control room or where there are particular local circumstances or risk factors, there may be justification for continuous sampling and/or automated shut-off facilities.

Where sustainable wetlands are installed as a secondary treatment system, these should be inspected monthly and litter removed. To minimise the effect on wildlife from routine maintenance operations, small areas of sediment or vegetation should be removed, where necessary, on a regular basis. Every three years the banks will require clearance. Damaged vegetation should be replaced and erosion repaired as necessary[34].

5.6 SAMPLING AND TESTING OF AQUEOUS EFFLUENT

5.6.1 Sampling

5.6.1.1 Introduction

The effluent streams leaving the facility should be sampled and checked against the site's discharge consent levels for compliance.

Checks of effluent quality should be carried out regularly (see section *5.6.1.3*) in a manner which ensures accuracy and repeatability.

A record of sample analysis results and inspections, and any action taken to ensure compliance with consent levels, should be recorded. This is likely to be a condition of a discharge consent.

5.6.1.2 Personnel

It is essential that those carrying out sampling are properly trained and have the correct equipment.

5.6.1.3 Frequency

The number of samples required to characterise a discharge varies according to local circumstances. It depends on the time of year, the nature of the pollutants, location of sampling point(s) and sensitivity of the parameter concentration to events over time. External variables which impact on the frequency of sampling include the sensitivity of the receiving waters, the consequences of exceeding certain criteria for a period of time and the views of the local or national regulatory bodies. The frequency of sampling may be specified in the discharge consent.

Samples can be taken for either visual inspection or for analysis. As a minimum standard, the interval between effluent sampling for analysis from a moderate sized facility should not exceed three months whereas visual inspections may be undertaken more frequently. On some sites visual inspections, e.g. for visible oil on the surface of discharge to surface waters, are made daily and a record kept of the observations. Additional data may be collected during specific events such as during storms, after spills or releases, or during low flow situations. As the complexity of a site and the sensitivity of the receiving environment increases, more frequent monitoring may be warranted.

5.6.1.4 Locations and techniques

Sampling locations within a distribution installation require careful consideration, as sampling needs to be meaningful and give representative values. It is important that the sampling point should be the same as that used by the regulatory authority.

It is recommended that where practicable a standard sampling chamber should be installed adjacent to the separator discharge, with, if possible, a free fall inlet to ensure turbulence.

In practice the separator discharge is often right at the site boundary and is the final location to sample effluent. Discharge from separators will often be at a single point into a pipe or culvert which carries the water off-site into a receiving water or local drainage system. The best representative sample would be taken at the point where the pipe discharges into the water course. Ideally what is required is an established flow of water directly into the sample container.

The preferred procedure for bulk or 'grab' sampling is from a falling water stream. If not feasible, direct submersion of the sample container to predetermined depth in the waste stream, and then opening of the container to allow a sample to flow in, may be used. Care should be exercised when taking the effluent sample not to disturb any particulates or matter on the sides of the pipe or to merely collect surface bloom, etc., which would result in an unrepresentative sample.

If a detailed study of the drainage system is needed, samples may be recovered from individual components of a site drainage system in order to evaluate the presence and concentrations of pollutants from specific areas of operation (e.g. drains from bunds or loading areas).

5.6.2 Sample handling, storage and transportation

Samples of effluent should be collected, transported and stored in the correct manner. This will ensure the final results obtained from the laboratory reflect, as far as is practicable, the true values on site.

The sample should be held and later transported in a suitably sized, clean, glass container, having an air tight lid with a seal made from a non-absorbent plastic, ideally PTFE coated rubber or a non-absorbent rubber such as Viton. The glass container should be filled to the brim and the cap placed on removing all of the air. As a check the container can be turned and the base inspected for any small air bubbles.

A label recording all the essential information required should be prepared in advance and then affixed to the appropriate sample container. The sample containers should be immediately stored at a temperature between 0 and 4 degrees C ready for transportation to the laboratory. This can be achieved by placing samples in a cool box partly filled with ice packs. The temperature should be monitored by a maximum/minimum thermometer.

The samples should be securely held to ensure the containers cannot slide or tip. Samples should be maintained at a temperature at or below 4 degrees C from the time of collection at each sample location and should be transported to the laboratory for testing within 48 hours.

5.6.3 Testing parameters

A sampling programme can comprise both simple visual checks (e.g. amount of sediment, visible oil on water) as well as the testing of parameters which could reasonably be expected to have an adverse effect on receiving water. These will often be detailed by the Regulatory Authority or described on the discharge consent. As indicators of contamination, parameters such as oil in water, total organic carbon (TOC) or total suspended solids (TSS) can be used. Other indicators such as pH and biochemical oxygen demand (BOD) can be included as supplementary tests if required. If other chemicals are expected (or suspected) they should be analysed for specifically.

The tests required for these various parameters are frequently complex and should be carefully controlled. It is recommended that a laboratory is used which meets UKAS (United Kingdom Accreditation Service) or local equivalent standards for the particular tests.

5.7 WASTE MANAGEMENT

5.7.1 Waste minimisation

The first rule in waste management is to minimise, wherever practicable, the generation of excess materials and wastes. Waste minimisation means the reduction of all wastes to the greatest economical and practical extent. It includes elimination, source reduction, recycling and treatment activities which result in either a reduction in quantity or hazardous properties of the waste, or both.

Source reduction includes process modifications and waste segregation. Recycling includes use, reuse or reclamation of wastes either on-site or off-site. Treatment is any process which reduces the waste quantity or toxicity prior to disposal.

The hierarchy of a waste management programme is:

Highest priority	Elimination at source
	Source reduction
	Recycling
	Treatment
Lowest priority	Final disposal

It is recognised that in implementing a waste minimisation programme consistent with regulatory requirements, economic factors will be a consideration. In the short term, waste minimisation can reduce the actual waste disposal costs incurred. However, long term benefits should not be ignored for short term expediency. Although the following benefits appear to be intangible they can improve profitability and therefore should be considered:

— Reducing long term environmental liabilities, e.g. strict financial liability for contaminated land.
— Promoting a positive image to company

stakeholders.
- Improving the heath and safety of employees who come into contact with the waste.
- Increasing operating efficiency and hence reducing costs.
- Exceeding any regulatory requirements e.g. duty of care.

Waste minimisation starts with good practice, which includes design, operating procedures, housekeeping, engineering standards, maintenance regimes, training, record keeping and overall management systems. Many of the improvements in this area cover operational or administrative changes and can often be implemented relatively quickly at low cost.

Examples include:

- Clear and precise written operating procedures for plant, equipment and activities.
- In-depth analysis of the costs versus benefits of the optimum maintenance cycle to improve equipment life and efficiency.
- Regular scheduled preventative maintenance programmes.
- Segregation of waste streams to avoid cross-contamination of the different types of waste and to increase recoverability.
- Improvement in storage conditions to avoid loss and/or contamination.
- Techniques to reduce the volume of waste, e.g. oily sludge filtration, compaction.
- Use of bulk materials or reusable containers in preference to small volume containers, e.g. laboratory chemicals.
- Introduction of motivation schemes for waste reduction and recycling.
- Collection, segregation and treatment of spilt or leaked material for reuse.
- Identification and elimination of all spills and leaks.

5.7.2 Disposal of liquid wastes and sludges

Special consideration should be given to the disposal of liquid wastes and sludges because they can pose a significant threat to the environment if not disposed of properly.

Liquid wastes include spent lubricants, brake fluids, solvents, detergents and oil/water mixtures from separators, tank water bottoms, etc. Sludges originate primarily from tank cleaning operations and oily water separators. In almost all cases, sludges will be classified as hazardous waste and should be disposed of accordingly.

5.8 TRAINING

Assuming that engineered systems are properly installed and maintained, it is the operation of the site that presents the greatest risk. Such risks can arise as a result of inadequate training or operator error. Training requirements should form an integral part of the site EMS.

The key issues to be addressed are:

- An awareness of the need for environmental protection.
- An awareness of the risks posed by the installation.
- The implementation of risk management procedures and controls.
- An awareness of emergency response procedures.

The development and application of operating procedures will identify further aspects requiring additional training.

Training provides another mechanism for reinforcing environmental considerations and demonstrating commitment to good environmental practices and procedures. It may also provide an opportunity to assess the environmental attitudes of those engaged in managing and operating the facility.

5.9 AUDITING

Auditing should be carried out as a way of measuring the efficiency of the operational processes and provide indications of areas for improvement. The audit should not be seen, as can be the case, as some sort of punishment or a reason for punishment. Auditing, therefore, should be carefully promoted as a useful tool to focus on the provision of better environmental performance.

5.10 SUMMARY

Set up good operating procedures and practices.

Good training is essential and the requirements should form an integral part of the site EMS.

Maintain vigilance to ensure that leaks and spills do not go unnoticed.

The primary operational tool against loss of tank integrity is effective inspection and maintenance.

A total tank inspection scheme should include:

- Observations made by site operators during routine duties.
- Scheduled in-service inspection examinations made

by an inspection engineer on an approximately annual frequency.
— An out-of service inspection.

The out-of-service inspection has traditionally been undertaken at fixed intervals, but consideration should be given to a risk-based inspection frequency as detailed in EEMUA Publication 159[27].

The efficiency of the oil-water separator should be maintained by proper operation, inspection and maintenance.

The effluent streams leaving the distribution installation should be sampled and checked with the site's discharge consent levels for compliance.

Samples of effluent should be collected, transported and stored in the correct manner.

Minimise wherever practicable the generation of excess materials and wastes.

6

DE-COMMISSIONING

6.1 SCOPE

De-commissioning activities range from the complete closure and demolition of a petroleum distribution installation to the replacement of individual tanks or pipe work.

6.2 POTENTIAL SOURCES OF POLLUTION

During de-commissioning product could be lost to ground during dismantling and removal of tanks, equipment or pipe work.

In addition, a risk could arise off-site if contaminated equipment is not disposed of in an appropriate manner.

6.3 GOOD PRACTICE

Consideration of de-commissioning and demolition should be taken into account during the design phase for newly installed equipment.

A risk assessment should be undertaken at the de-commissioning planning stage to identify any hazards that may incur.

The preliminary steps in the de-commissioning process are:

- Ensure appropriate controls are in place prior to the start of activities e.g. permits.
- Isolate the equipment from any process or storage vessel by either removing pipe sections, taking care to prevent any spills from pipes as they are opened and removed, or fitting spades or blanks. Isolation valves by themselves are not adequate.
- Empty the equipment of product as much as possible, taking care that no product is lost to ground.
- If water is used to assist in the removal of product, the contaminated water should be drained at a controlled rate to the oil-water separator (see Section 5.1.6).
- Open access hatches of tanks to assist venting.

Tanks that are being de-commissioned temporarily should be made safe through cleaning or by filling with water. Regular inspections should be undertaken to ensure that the tank remains in a safe condition. It should be noted that the inner shell surface of carbon steel tanks that have been filled with water will, when emptied, rust rapidly which can result in dangerous oxygen depletion of the tank atmosphere if the tank is sealed.

Tanks which are being de-commissioned permanently should be made safe by thorough cleaning and gas freeing. Any entry points should be physically closed or barred to prevent unauthorised access. Alternatively large door sections of the tank shell can be removed to make the development of an unsafe atmosphere impossible.

Demolition of tanks that have contained flammable or other hazardous substances (e.g. leaded gasoline) is potentially very dangerous. It is strongly recommended that special tank demolition companies with the relevant expertise and equipment are used.

Guidance on the demolition of above ground tanks is provided in EEMUA Publication 154[40]. Guidance on the decommissioning and removal of underground storage tanks is provided in the Pollution Prevention Guideline PPG27[41] and in the Scottish Executive publication *Underground storage tanks for liquid hydrocarbons: Code of practice for the owners and operators of underground storage tanks (& pipelines)* [14].

It is recommended that the demolition of equipment above- and below-ground level should be undertaken separately. The potential to combine below-ground demolition with remediation should be reviewed.

Pollutants in soil and groundwater may constitute a risk. In order to safeguard health and the environment, to comply with legal requirements, and to ensure that soil and groundwater contamination is dealt with in the most effective way, it is important to be fully aware of the type, extent and significance of any contamination present on the site. Such information is also required to ensure that all liabilities associated with the acquisition, sale or transfer of land are fully understood.

For a more detailed description of recommended investigation procedures for possible petroleum based contamination and subsequent procedures to assess its relevance and any remedial measures necessary, reference should be made to the IP *Code of practice for the investigation and mitigation of possible petroleum based land contamination* [42].

6.4 SUMMARY

A risk assessment should be undertaken at the planning stage to identify any hazards that de-commissioning may incur.

Isolate any equipment being de-commissioned from any process or storage vessel by either removing pipe sections or fitting spades or blanks. Isolation valves by themselves are not adequate.

Empty the equipment of product as much as possible, taking care that no product is lost to ground.

Any contaminated water should be drained at a controlled rate to the oil-water separator.

7

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ANNEX A

UK LEGISLATION

The following information is correct at the time of publication of these Guidelines. To check the current position on legislation, various reference books are available, such as Croners.

Health And Safety At Work Act 1974

This Act has statutory implications for the petroleum distribution sector of the oil industry by imposing the need for safe systems of work (HASWA Section 2).

The Environmental Protection Act 1990

This Act provides a statutory framework for the control of a wide range of activities that can affect the environment. Part I of the Act introduced the system of integrated pollution control (IPC) under which an operator requires an authorisation to operate certain processes which have the potential to cause significant pollution. An operator is required to use BATNEEC (best available techniques not entailing excessive cost) to prevent, or where that is impracticable, minimise and render harmless, the release of prescribed substances in a way that takes account of the environment as a whole. Part II of the Act provides for control of waste management. It places a duty of care for waste management on anyone who produces, imports, carries, treats, keeps, or disposes of controlled waste, e.g. industrial, commercial or domestic waste. Part III of the act covers Statutory Nuisance.

Town And Country Planning Act 1990

Planning authorities may set remediation goals for a contaminated site or conditions for the granting of planning consents.

Water Resources Act 1991

This Act applies in England and Wales and came into effect on 1 December 1991. It deals with the water management, water pollution, flood defence and fisheries functions and responsibilities of the Environment Agency and replaced the corresponding sections of the Water Act 1989. It covers:

— Discharge consents.
— S85 provisions relating to the offence of causing or knowingly permitting the entry of toxic, noxious or other polluting matter to controlled waters. It should be noted that groundwater is controlled water.
— S161 provisions relating to the power for the Environment Agency to issue a notice for pollution prevention works.

In Scotland similar matters are controlled by the Water Environment (Controlled Activities) (Scotland) Regulations 2005 made under the Water Environment and Water Services (Scotland) Act 2003. In Scotland, SEPA does not have control of flood defence or fisheries but the Controlled Activities Regulations empower it to control abstractions, impoundments and river engineering activities as well as point source discharges.

Water Industry Act 1991

This Act requires that a Trade Effluent Consent must be obtained from the local Water Company in order to discharge trade effluent into a public sewer.

In Scotland similar matters are controlled under the Sewerage (Scotland) Act 1968 as amended by the Water Environment and Water Services (Scotland) Act 2003.

Controlled Waste Regulations 1992

These Regulations were introduced with the objective of clarifying the definition of types of controlled waste with particular emphasis on industrial wastes.

Waste Management Licensing Regulations 1994

These Regulations define the term "waste" and set up a waste management licensing system. They also transpose the requirements of the Groundwater Directive as it applies to waste activities.

Conservation (Natural Habitats, &c.) Regulations 1994

These Regulations transpose the EU Habitats Directive [7] into national law. They provide for the designation and protection of "European sites", the protection of "European protected species", and the adaptation of planning and other controls for the protection of European Sites.

Special Waste Regulations 1996

These Regulations are concerned with those wastes which are seen as being the most hazardous and were introduced in response to the Directive on Hazardous Waste (91/689/EEC). Special wastes are those which are seen as being dangerous to life according to certain criteria. For definition of these criteria, see the Special Waste Regulations 1996 (S1 1996/972).

Town And Country Planning (Scotland) Act 1997

Regulates the location of developments and the control of operations in order to avoid or minimise adverse effects on the use of land and on the environment (including groundwater) and to secure restoration to a condition capable of the agreed after-use.

Groundwater Regulations 1998

Together with the Waste Management Licensing Regulations, these transpose the EU Groundwater Directive [6] into UK law. The purpose of the Directive is "to prevent the pollution of groundwater by substances belonging to the families and groups of substances in lists I or II in the Annex [to the Directive]".

More specifically the aim is to:
- Prevent the introduction of List I substances into groundwater and;
- Avoid the pollution of groundwater by List II substances.

Most hydrocarbons are List I substances in the UK. The Joint Agencies Groundwater Directive Advisory Group makes recommendations to the Secretary of State if any substances should be moved from List I to List II.

Disposals and discharges of listed substances are controlled by authorisations or other permits that act as authorisations for the purposes of the Groundwater Regulations. Other activities that result in the introduction of a listed substance to groundwater may be controlled by discretionary powers, such as the serving of notices to restrict or prohibit the activity. Discharges found by the competent authority to contain substances in List I or II in a quantity and concentration so small as to obviate any present or future danger of deterioration in quality of the receiving groundwater may be excluded from the Regulations.

A discharge consent for disposal of waste-water to ground will also function as an authorisation under the Groundwater Regulations. Similar considerations apply to PPC permits.

In Scotland, discharges to groundwater are controlled via the Controlled Activity Regulations in a similar manner to England.

Control of Major Accident Hazards Regulations (COMAH) 1999

The COMAH Regulations implement EC Directive 96/82/EC (known as the Seveso II Directive). COMAH is implemented by a Competent Authority jointly consisting of the Health and Safety Executive (HSE) and the Environment Agency (for England and Wales) or the Scottish Environment Protection Agency (for Scotland).

It came into force on 1st April 1999 and it aims to prevent major accidents involving dangerous substances and limit the consequence to people and the environment of any which do occur.

The Regulations apply at two thresholds, the lower-tier and top-tier, depending upon the quantity of dangerous substances stored. For petroleum products, which are defined as gasolines and naphthas, kerosenes (including jet fuels) and gas oils (including diesel fuels, home heating oils and gas oil blending streams), the thresholds for the two tiers are 2 500 te and 25 000 te respectively. If the lower-tier threshold is equalled or exceeded, operators must notify the Competent Authority. The operator must also prepare a Major Accident Prevention Plan (MAPP). If the top-tier threshold is equalled or exceeded, operators must comply with additional requirements to provide a Safety report and have an on-site emergency plan. Local authorities must also prepare an off-site emergency plan for each top-tier site.

Control of Pollution (Oil Storage) (England) Regulations 2001

These Regulations set a minimum standard for oil storage facilities at industrial, commercial and institutional premises. They require primary containment which is fit for purpose and the provision of secondary containment, as well as a number of detailed measures related to pipe work and security. Refineries and petroleum distribution installations are exempt from the requirements of these Regulations.

ANNEX B

DESIGNS OF OIL-WATER SEPARATORS

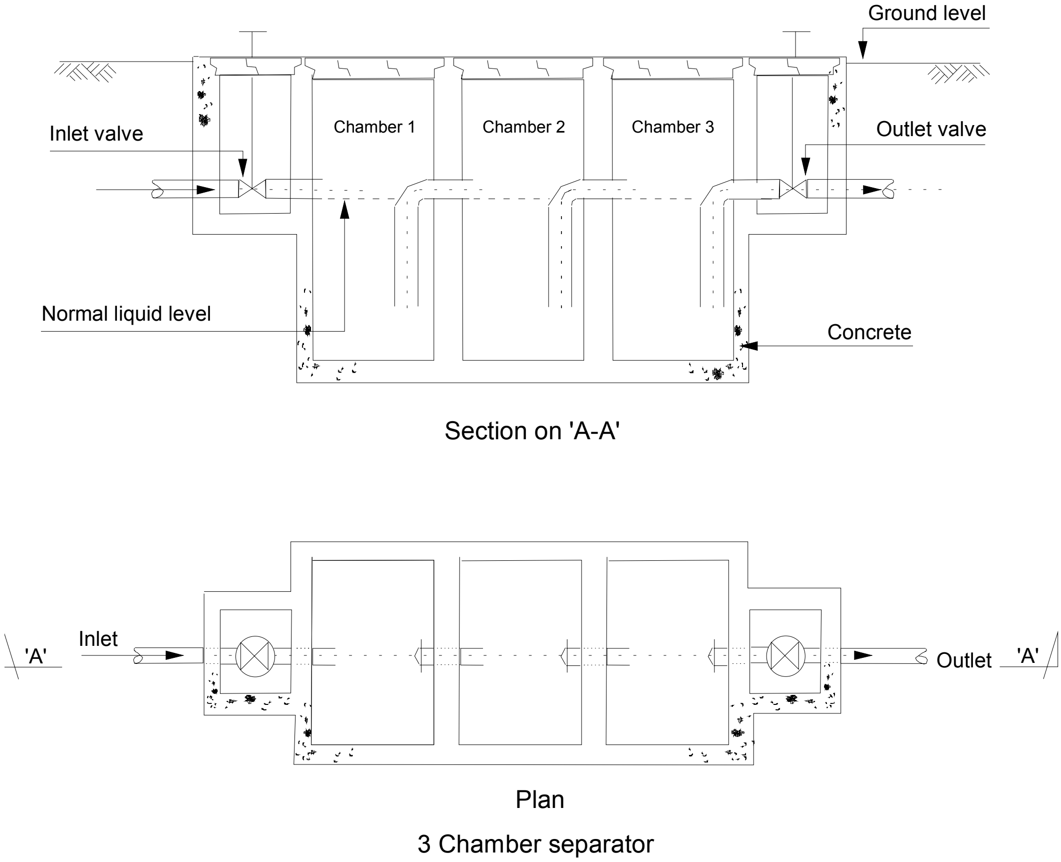

Figure A.2.1: Schematic diagram of 3 chamber type separator

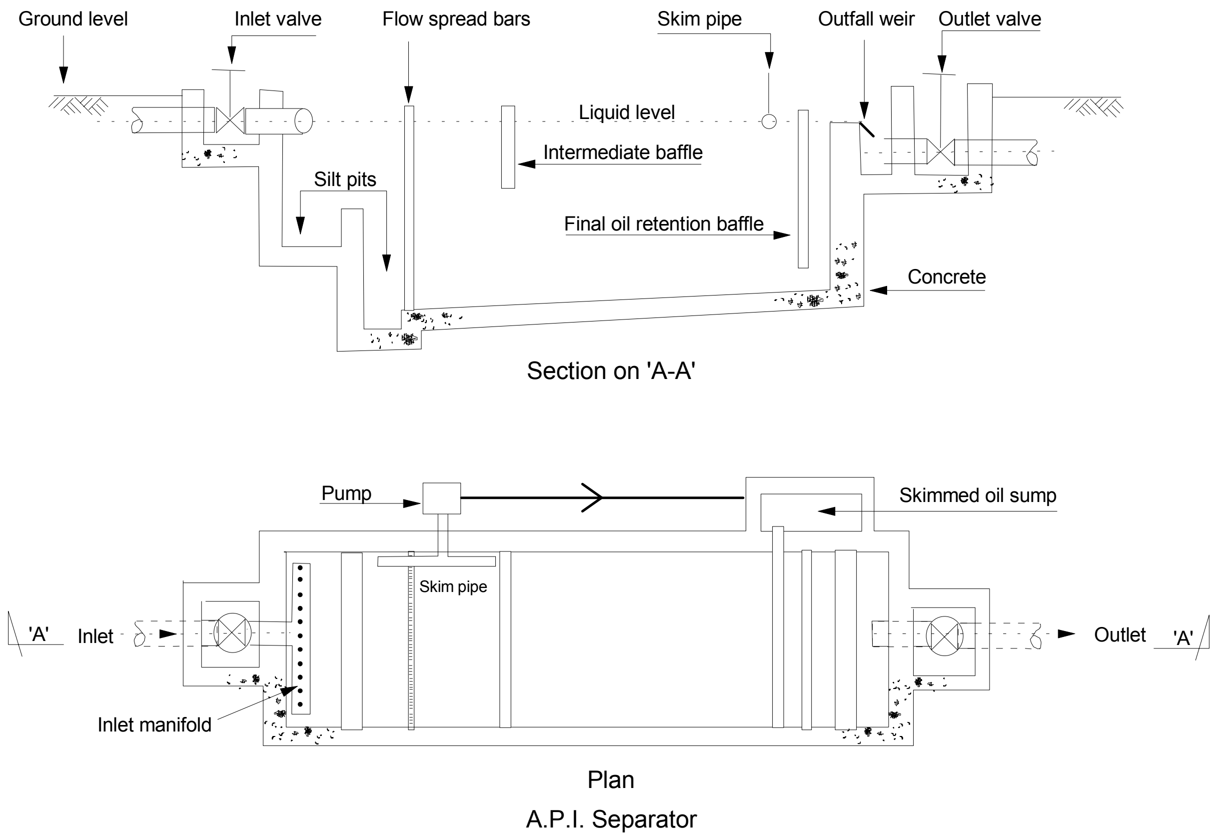

Figure A.2.2: Schematic diagram of API type separator

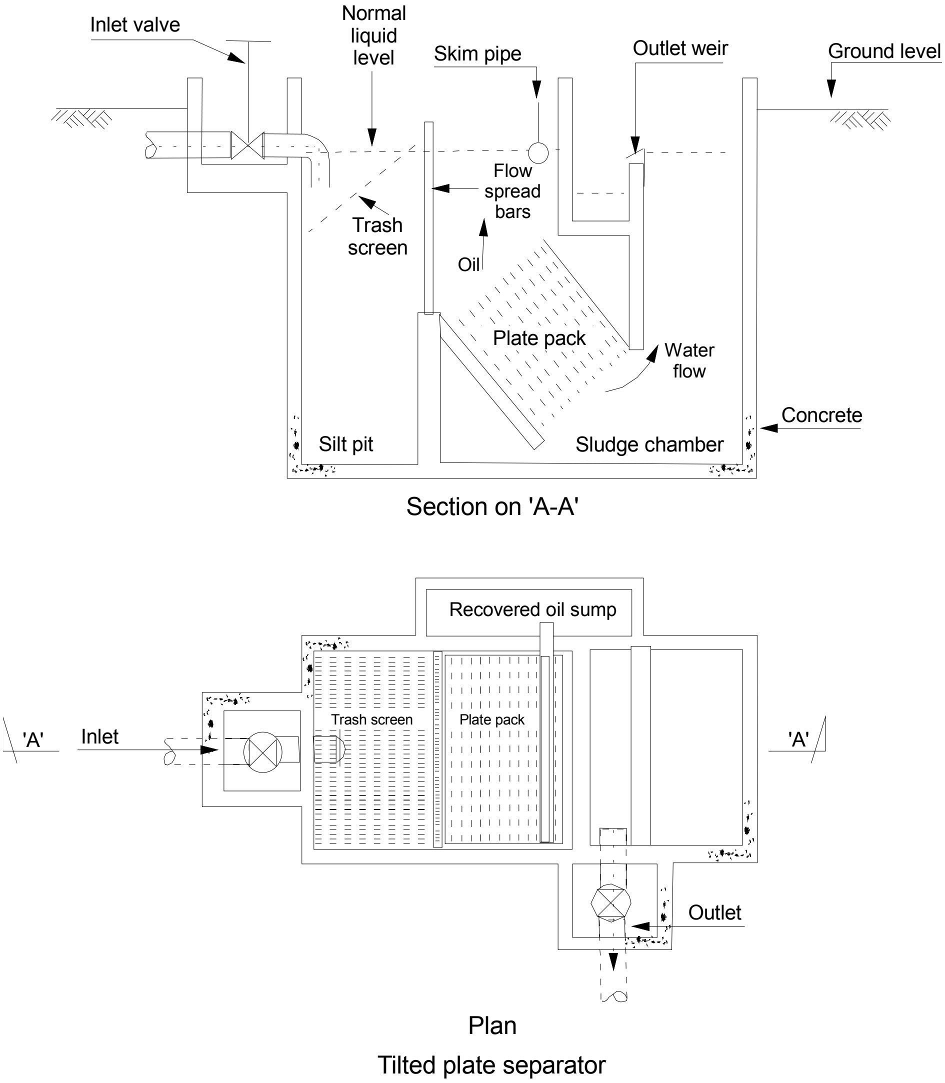

Figure A.2.3: Schematic diagram of tilted plate type separator

ANNEX C

GLOSSARY OF TERMS

authorised distributors: companies who distribute oil products, usually from small installations, sometimes but not always using the supplying company logo.

automatic sensing valves: valves used for water draw-off which sense the change in density from water to product and then close automatically.

bunds: embankments, walls or barriers surrounding a storage tank(s) or similar facility, intended to provide containment in the event of a spillage.

cathodic protection: a mechanism to protect steel equipment, (typically pipe work or tank bottoms), from corrosion by using either sacrificial anodes or electrical current.

consent: a consent to discharge effluent given by the authority responsible for the surface or groundwater into which the effluent will go. The consent will usually specify the maximum daily volume and allowable levels of contamination in the discharge.

controls: management checks of various kinds built into the procedures to ensure that the facilities are being operated correctly.

controlled waters: those subject to legislative constraints. In England and Wales "controlled waters" are defined in the Water Resources Act 1991. In Scotland they are defined in the Control of Pollution Act 1974.

discharges: the final water flow leaving a petroleum distribution installation and entering a controlled water.

double bottom: a second floor in a product tank, leaving a small space between the two which can be monitored to detect a leak.

dry-break couplings: type of coupling used to join a hose to a pipe where the two halves of the couplings automatically seal so that no product is spilled as they are moved apart.

effluent streams: discharges of contaminated or uncontaminated water.

emissions: oil products, vapour or liquid released from a petroleum distribution installation in the course of its operation.

environmental impact: the expected effect on the environment of any emission or discharge from or action taken by the petroleum distribution installation.

geodesic domes: light weight roof fitted over an external floating roof storage tank, so called because of the structural design.

groundwater: water in the ground below the watertable. The Groundwater Directive specifically defines this as "all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil".

hazardous areas: parts of the petroleum distribution installation where there is a risk that flammable vapours or other dangers may be present.

hold-open valves: valves which must be held open manually. They are designed to close when released.

impervious bund: secondary containment comprising an area where the floor and walls of the bund are substantially impermeable to the products stored in the primary containment system (tank and immediately associated pipe work).

integrity management: the total management of facilities to ensure that they do not leak or cause pollution of the environment.

line management: management personnel responsible for the day to day operations.

List I and List II substances: dangerous substances requiring control under the Groundwater Directive. Hydrocarbons are List I substances and the Directive prohibits their introduction into groundwater.

performance targets: the environmental performance, expressed as actual measurements, (e.g. oil in water, BOD, etc.) which the petroleum distribution installation is expected to meet.

pressure relief: facilities installed to prevent damage to pipe work and other equipment caused by excess pressures in the system arising from such things as thermal expansion or product pumps.

procedures: formal (usually written) instructions for the operation of petroleum distribution installation.

refinery off-sites: facilities such as storage tanks, jetties, road and rail loading which are separate from the processing equipment.

release: any oil product or other pollutant allowed to escape into the environment.

remediation: the process of reducing the levels of pollution in soil and groundwater.

spading: inserting a blank plate between flanges on a piece of equipment to prevent product flow.

statutory consents: performance targets set by local or national regulatory authority for any emission or discharge from the petroleum distribution installation.

trade effluent: an aqueous discharge to the public foul sewer system.

waste: material, other than effluent, which is disposed of in accordance with existing legislation.

work permit: special procedures required where the operation to be carried out may be hazardous.