epa
Office of
Environmental
Enforcement

Guidance on assessing and costing environmental liabilities

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable. The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

OUR RESPONSIBILITIES

LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- waste facilities (e.g., landfills, incinerators, waste transfer stations);
- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities.
- waste water discharges
- dumping at sea

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 1200 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the
- areas of -air, noise, waste, waste-water and water quality.
- Working with local authorities and the Garda' to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

MONITORING, ANALYSING AND REPORTING ON THE ENVIRONMENT

- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments.
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors. The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

Office of Environmental Enforcement

Guidance on assessing and costing environmental liabilities

2014

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1. Introduction

1.1. General introduction

This guidance presents a systematic approach for assessing and costing environmental liabilities associated with:

- Closure and restoration/aftercare; and
- Incidents.

There are several benefits of proper environmental liability management, including:

- Minimised/eliminated residual environmental impacts upon closure;
- Reduced potential for environmental impact resulting from incidents;
- Forward financial planning for environmental liabilities; and
- Reduced cost of financial provision.

This guidance is targeted at activities falling under the various Environmental Protection Agency (EPA) authorisation regimes including the Industrial Emissions Directive (IED), Integrated Pollution Prevention and Control (IPPC), waste, waste water discharge (WWD) and dumping at sea (DaS).

EPA authorisations require closure and restoration/aftercare plans and environmental liabilities risk assessments to be to the satisfaction of and agreed with the EPA. **This guidance sets the standard that closure and restoration/aftercare plans and environmental liabilities risk assessments must meet to satisfy EPA requirements.** This guidance will also facilitate compliance with EPA requirements when preparing such reports in the context of applications for authorisations and transfers of same. Furthermore, should closure become a reality, this guidance will enhance the prospects of obtaining successful closure or surrender of an authorisation.

This guidance replaces *Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision* (EPA, 2006) in relation to assessing and costing environmental liabilities. The most significant amendments are:

- Updates to reflect changes in legislation since 2006.
- Updates to reflect the wider remit of the EPA since 2006, e.g. waste water discharge and dumping at sea regulations.
- Removal of the screening approach contained in the 2006 guidance. The screening approach exempted low-risk activities from environmental liability risk assessment (ELRA), and required a generic ELRA for moderate-risk activities and a site-specific ELRA for high-risk activities. Under this guidance, the same methodology and principles apply. The level of assessment is instead expected to be driven by and proportionate to the nature of the activity and associated risks.
- Greater definition of the approach for identifying and costing closure and restoration/aftercare.
- Amendment of the environmental liability risk assessment approach, in particular the costing part, and provision of example risks.
- Updates to the unit cost rates.

The EPA will assess all environmental liability reports against the requirements of this guidance. Therefore, operators should review reports before submitting them to EPA to ensure they meet the requirements set out herein.

This guidance covers numerous types of activities and cannot account for every situation and possible valid exception that might apply. In the event that an operator considers there is a valid case-specific reason to depart from this guidance, it is recommended they consult in advance with the EPA to avoid reports being rejected.

The assessment and costing of environmental liabilities is frequently the basis for making financial provision. Financial provision is therefore referred to in this document; however, guidance is not provided on making financial provision. The EPA will issue separate updated guidance on financial provision.

Operators should have due regard when undertaking assessments to requirements emanating from other regulation regimes that may overlap, e.g. planning permissions, mining licences, radioactive waste legislation.

1.2. Key terminology

The terminology associated with environmental liabilities is complex. Various terms are used in reference to closure and restoration/aftercare, including: closure, decommissioning, residuals management, rehabilitation, remediation, restoration and aftercare. Various terms are also used in reference to closure and restoration/aftercare plans, including most commonly: closure, restoration and aftercare management plan (CRAMP); decommissioning management plan (DMP); and residuals management plan (RMP). Furthermore, the term 'environmental liability risk assessment' (ELRA) is sometimes used in reference to incidents only, and in other cases to a combined assessment covering closure, restoration/aftercare and incidents.

In this guidance:

Closure refers to relatively short-term measures necessary to close a site satisfactorily, including decommissioning and residuals management. **Closure plan** should be read accordingly.

Restoration/aftercare refers to longer term measures that are necessary where environmental liabilities remain following closure, e.g. contaminated soil and groundwater, landfills, extractive waste facilities, mines, quarries and soil recovery facilities. Measures may encompass activities such as rehabilitation, remediation, restoration, ongoing emissions control and monitoring. **Restoration/aftercare plan** should be read accordingly.

Environmental liabilities risk assessment refers to the assessment and costing of liabilities arising from incidents. **Incident** generally refers to a change of circumstances from the norm with actual or potential negative consequences. The IED refers to incidents and accidents, but for the purposes of this guidance the term 'incident' only is used, and is taken to include accidents within its meaning.
Financial provision refers to the putting in place of a financial instrument (such as an insurance, bond, guarantee or fund) to cover the costs of closure, restoration/aftercare or incidents. Other terms referring to essentially the same thing may be seen elsewhere such as financial security, financial guarantee and financial mechanism.

A glossary of terms and abbreviations is provided at the end of this document.

1.3. Structure of this guidance

The approach for assessing and costing environmental liabilities is illustrated in **Figure 1.1.** This guidance note follows the same structure.

The methodology for identifying, assessing and costing closure and restoration/aftercare is presented in **Section 2** of this guidance. Sites with no soil or groundwater contamination or other long-term liabilities require a closure plan only. Sites with soil or groundwater contamination and certain sectors such as landfills and mines require a closure plan and a restoration/aftercare plan. The methodology for assessing and costing liabilities associated with incidents, i.e. ELRA, is presented in **Section 3** of this guidance.

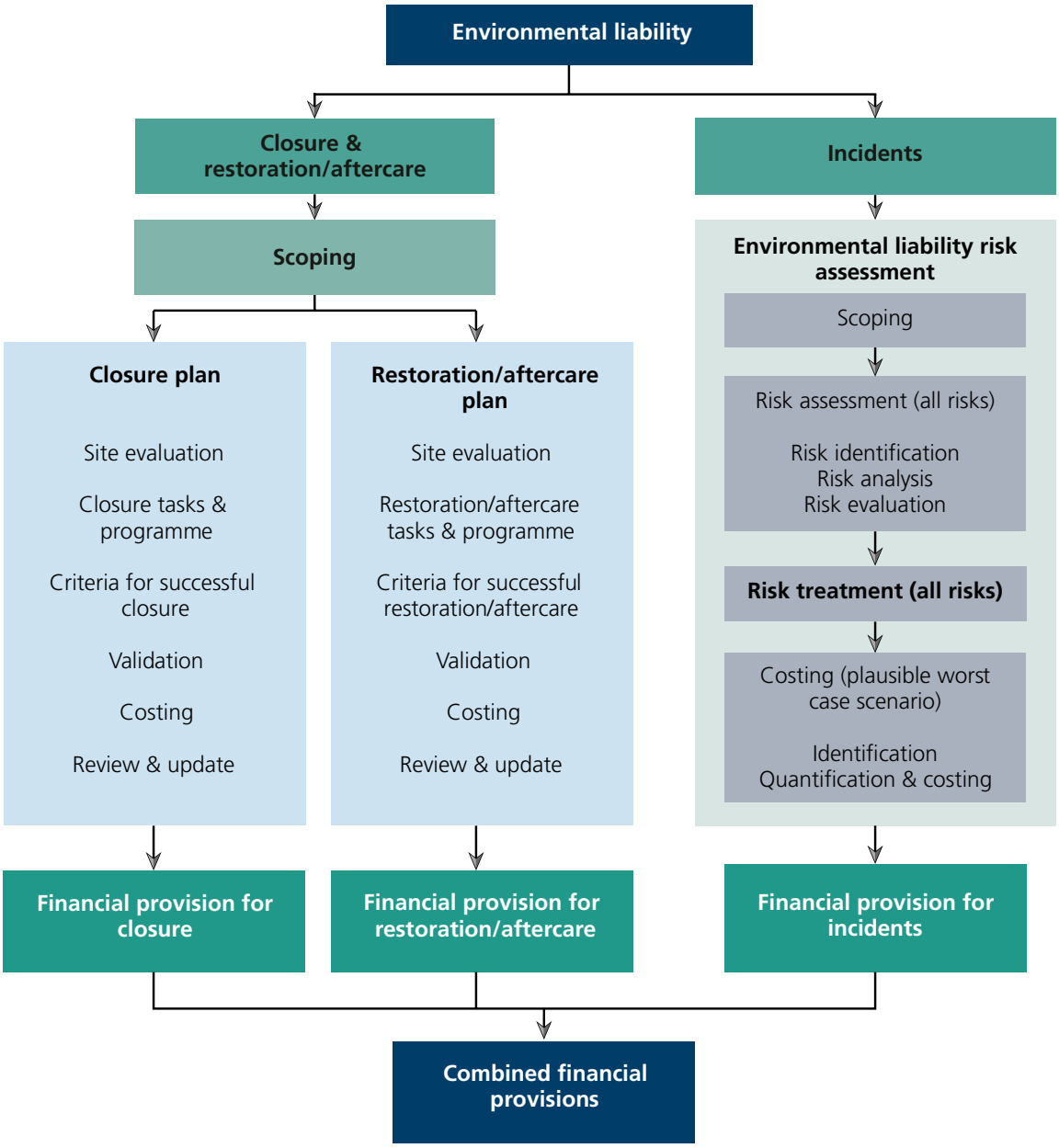

Figure 1.1: Assessing and costing environmental liabilities

1.4. Legal framework

1.4.1. European Union law

There are a number of EU Directives that set the legal framework for environmental liabilities.

The Environmental Liability Directive (2004/35/EC) aims to prevent and remedy environmental damage and to reinforce the 'polluter pays' principle, making an operator that causes environmental damage legally and financially liable for the damage caused and the subsequent remediation. There is an incentive for operators to proactively assess their environmental risks and manage them in order to prevent environmental damage from occurring. Furthermore, the Directive requires operators to initiate preventative measures where there is an imminent threat of environmental damage occurring. Any holder of an authorisation from the EPA is strictly liable for any environmental damage and must legally cover the costs of any subsequent remediation. The Directive is transposed into Irish law via the European Communities (Environmental Liability) Regulations, 2008 (S.I. No. 547/2008). Further information is available in *Environmental Liability Regulations – Guidance Document* (EPA, 2011).

Other Directives such as the Integrated Pollution Prevention and Control Directive (2008/1/EC), the Industrial Emissions Directive (2010/75/EU), the Waste Framework Directive (2008/98/EC), the Landfill Directive (1999/31/EC) and the Mining Waste Directive (2006/21/EC) also include specific provisions relating to accident prevention, closure and, in some cases, financial provision. For example, the Integrated Pollution Prevention and Control Directive contains specific measures that place the responsibility on the operator *'to prevent accidents and limit their consequences'* and *'upon definitive cessation of activities, to avoid any pollution risk and return the site of operation to a satisfactory state'*. The Landfill Directive and Mining Waste Directive require financial provision to ensure that all obligations under the licence, including after-closure provisions, are fully discharged.

1.4.2. Irish law

IED, IPPC and waste

Under the IED, IPPC and waste licensing regimes, the EPA is prohibited from granting a licence or revised licence unless it is satisfied of a number of matters, including:

- emissions from the activity will not cause significant environmental pollution;
- necessary measures will be taken to prevent and to limit the consequences of accidents and to remedy those consequences;
- necessary measures will be taken upon permanent cessation (including abandonment) to avoid any risk of environmental pollution and return the site to a satisfactory state;
- the applicant or licensee or transferee, as the case may be, is a fit and proper person to hold a licence; and
- in the specific case of landfill, applicants have complied with the requirements for provision of financial security under Section 53 of the Waste Management Acts, 1996 to 2011.

A person shall be regarded as a fit and proper person if (among other things):

> *'in the opinion of the Agency, that person is likely to be in a position to meet any financial commitments or liabilities that the Agency reasonably considers have been, or will be entered into or incurred by him in carrying on the activity to which the licence or revised licence relates or will relate, as the case may be, in accordance with the terms thereof or in consequence of ceasing to carry on that activity.'*

The EPA may grant a licence subject to such conditions as it considers appropriate, including conditions requiring that:

- the necessary measures be taken upon permanent cessation (including abandonment) to avoid any risk of environmental pollution and return the site to a satisfactory state;
- requirements for the closure, restoration, remediation or aftercare in relation to the activity concerned be specified;
- the necessary measures be taken to prevent accidents and, where an accident occurs, to limit and remedy its consequences for the environment; and
- evidence be furnished of financial provision in relation to the licensee's ability to meet the financial commitments or liabilities that the EPA reasonably considers will be incurred in carrying on the activity.

Waste water discharges

Under Waste Water Discharge Regulations, the EPA shall not grant an authorisation for a WWD where the discharge will:

- cause a deterioration in the chemical status or ecological status/ potential in the receiving body of surface water;
- cause a deterioration in the chemical status in the receiving body of groundwater or which fails to include the measures necessary to prevent the input into groundwater of hazardous substances, except where the discharge is agreed with the EPA; or
- compromise the achievement of the objectives established for protected species and natural habitats in the case of European sites.

The EPA may attach conditions necessary to give effect to the requirements of existing environmental legislation in the field of water policy, including compliance with the Water Framework Directive and the prevention of impacts to designated European sites.

Dumping at sea

The DaS legislation states that any application for a permit shall furnish to the EPA such information as the EPA may consider necessary for the purpose of the exercise of functions under this legislation. The legislation states that a permit shall contain such conditions as the EPA considers appropriate and operators must indemnify the EPA.

1.4.3. Licence/permit conditions

The EPA attaches specific conditions in authorisations, where necessary, in relation to closure and restoration/aftercare plans, environmental liability risk assessments and financial provisions. There is some variation in conditions. Typical requirements are presented in this section. In all cases, operators should consult the wording of the licence conditions in conjunction with this guidance document prior to commencing assessment.

The typical requirements for a closure plan are presented in **Box 1**. The requirement for financial provision is included in the condition. Closure and restoration/aftercare conditions vary and licences for landfills and extractive industries, for example, will have additional requirements.

The typical requirements for an ELRA are presented in **Box 2**. The requirement for financial provision is included in the condition. There may be overlap between conditions relating to ELRA and closure and restoration/aftercare. Some licences will only contain a requirement for an annual statement of measures (the first paragraph of **Box 2**).

Box 1: Typical Closure Plan Condition

Following termination, or planned cessation for a period greater than six months, of use or involvement of all or part of the site in the licensed activity, the licensee shall, to the satisfaction of the Agency, decommission, render safe or remove for disposal/recovery any soil, subsoil, buildings, plant or equipment, or any waste, materials or substances or other matter contained therein or thereon, that may result in environmental pollution.

The licensee shall prepare, to the satisfaction of the Agency, a fully detailed and costed plan for the decommissioning or closure of the site or part thereof. This plan shall be submitted to the Agency for agreement within six months of the date of grant of the licence.

The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER [annual environmental report]. No amendments may be implemented without the agreement of the Agency.

The licensee shall have regard to the Environmental Protection Agency Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision when implementing Condition # above.

The Decommissioning Management Plan shall include, as a minimum, the following:

i. a scope statement for the plan;
ii. the criteria that define the successful decommissioning of the activity or part thereof, which ensures minimum impact on the environment;
iii. a programme to achieve the stated criteria;
iv. where relevant, a test programme to demonstrate the successful implementation of the decommissioning plan; and
v. details of the costings for the plan and the financial provisions to underwrite those costs.

A final validation report to include a certificate of completion for the Decommissioning Management Plan, for all or part of the site as necessary, shall be submitted to the Agency within three months of execution of the plan. The licensee shall carry out such tests, investigations or submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment

Box 2: Typical ELRA Condition

The licensee shall as part of the AER, provide an annual statement as to the measures taken or adopted at the site in relation to the prevention of environmental damage, and the financial provisions in place in relation to the underwriting of costs for remedial actions following anticipated events (including closure) or accidents/incidents, as may be associated with the carrying on of the activity.

The licensee shall arrange for the completion, by an independent and appropriately qualified consultant, of a comprehensive and fully costed Environmental Liabilities Risk Assessment (ELRA) which addresses the liabilities from past and present activities. The assessment shall include those liabilities and costs identified in Condition # for execution of the DMP. A report on this assessment shall be submitted to the Agency for agreement within twelve months of date of grant of this licence. The ELRA shall be reviewed as necessary to reflect any significant change on site, and in any case every three years following initial agreement. Review results are to be notified as part of the AER.

As part of the measures identified in Condition #, the licensee shall, to the satisfaction of the Agency, make financial provision to cover any liabilities associated with the operation (including closure, restoration and aftercare). The amount of indemnity held shall be reviewed and revised as necessary, but at least annually. Proof of renewal or revision of such financial indemnity shall be included in the annual 'Statement of Measures' report identified in Condition #.

The licensee shall revise the cost of closure, restoration and aftercare annually and any adjustments shall be reflected in the financial provision made under Condition #.

The licensee shall have regard to the Environmental Protection Agency Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision when implementing Conditions # and # above

2. Closure and restoration/aftercare

2.1. Introduction

The overall purpose of closure and restoration/aftercare is to ensure that the necessary measures are taken to avoid any risk of environmental pollution and, where pollution has been caused, to return the site to a satisfactory state. Activities authorised under the Industrial Emissions Directive (2010/75/EU) that have caused significant pollution of soil or groundwater by relevant hazardous substances must be returned to baseline conditions, subject to technical feasibility. A baseline report must be prepared when authorised to provide a benchmark upon closure. Operators must ensure that these requirements are met in order to close out the closure and restoration/aftercare phase of an activity. There are provisions in law for surrender of EPA authorisations where the EPA is satisfied that the condition of the site is not causing or likely to cause environmental pollution.

Closure and restoration/aftercare plans are generally required to be prepared by the operator. Operators should examine relevant conditions of their authorisation in this regard. In most cases operators are well placed to prepare the plans including the costings themselves. However, external expertise should be used where necessary to ensure that the plans meet the standards required here. This might be appropriate in particular for new entrants/applicants who do not have operational experience of quantities and costs relating to, for example, cleaning and waste management.

It should also be noted that the assessment of the costings for closure and restoration/aftercare of extractive waste facilities subject to Article 14 of the Extractive Waste Directive must be done by independent and suitably qualified third parties [Article 1(2) of Commission Decision 2009/335/EC].

2.2. Steps in the process

There are three steps to completing closure and restoration/aftercare plans:

- Step 1: Scoping
- Step 2: Closure
- Step 3: Restoration/aftercare

Figure 2.1 illustrates the overall closure and restoration/aftercare process. An example of a plan is given in **Appendix A** of this document.

2.3. Scoping

The requirements for closure and restoration/aftercare vary between sites and it is necessary to scope closure. In addition, it is necessary to decide if restoration/aftercare is required and, if so, to scope restoration/aftercare. Closure and restoration/aftercare can be broadly summarised as follows:

- **Closure** and **closure plan** refer to relatively short-term measures necessary to close a site satisfactorily including decommissioning and residuals management. For many sites, there will be no environmental liabilities once closure, decommissioning and residuals management are completed, and so only a closure plan is required.
- **Restoration/aftercare** and **restoration/aftercare plan** refer to longer term measures that are necessary where environmental liabilities remain following closure, e.g. contaminated soil and groundwater, landfills, extractive waste facilities, mines, quarries and soil recovery facilities. Measures may encompass activities such as remediation, rehabilitation, reinstatement, ongoing emissions control and monitoring.

In relation to soil and groundwater contamination, where it is relatively limited and will be addressed by short-term actions such as removal for treatment off-site, this can be addressed as part of the closure plan. A restoration/aftercare plan is required only where the measures necessary are more complex and long-term, e.g. installation of barriers, pump and treat, monitored natural attenuation.

Operators with an authorisation should refer to the conditions of the authorisation at the scoping stage. The activities carried out at an authorised site may be broad and include a number of classes. In addition, a site may have areas that will require a closure plan only and other areas that require a restoration/aftercare plan as well, e.g. a pharmaceutical site with an on-site landfill. It may be useful to divide the site into clearly designated areas when preparing the closure and restoration/aftercare plans.

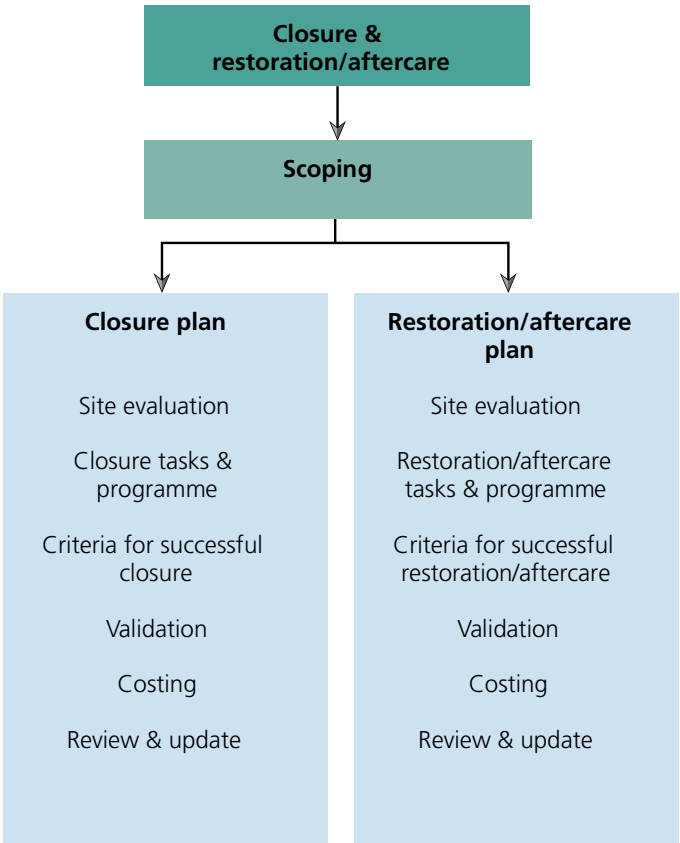

Figure 2.1: Closure and restoration/aftercare process

2.4. Combined closure and restoration/aftercare plans

It is expected that a restoration/aftercare plan, where required, will frequently be combined with a closure plan. In that case, it is only necessary to provide summary and background information once (see **Sections 2.5.1** to **2.5.3**). The remainder of the document should then address closure (see **Sections 2.5.4** to **2.5.8**) followed by restoration/aftercare (see **Section 2.6**).

2.5. Preparation of the closure plan

The closure of a site includes the decontamination and decommissioning of all plant and equipment. This may involve the removal, reuse or recycling of the plant and equipment, or, where plant and equipment is left in-situ for future use, it should be decontaminated and cleaned. During closure all wastes must be removed off-site at the time of closure for appropriate recovery or disposal.

As a minimum, the closure plan should contain the elements listed in **Table 2.1** as discussed in **Sections 2.5.1** to **2.5.8**. Specific guidance in gathering the information necessary to prepare the plan is provided in the following sections. Valuable sources of information include:

- planning and environmental impact assessment (EIA) documentation;
- licence/permit application form and attachments;
- AER;
- environmental management systems (EMS);
- risk based methodology for enforcement (RBME) inputs for IED, IPPC and waste activities;
- dynamic risk-based enforcement methodology (DREAM) inputs for waste water discharges;
- national environmental mapping databases from the EPA, National Parks and Wildlife Service, Geological Survey of Ireland, etc.; and
- other sources (e.g. Health and Safety Authority (HSA) risk assessments, Seveso reports, appropriate assessments).

2.5.1. Closure plan summary

This section should summarise the closure plan, including the following as a minimum:

- activity name and address;
- name of the operator;
- licence/permit number;
- name and address of person/organisation who prepared the plan;
- classes of activity licensed/permitted and carried out;
- risk category, e.g. RBME or DREAM;
- scope: closure plan only or restoration/aftercare plan also;
- overall closure costs;
- details of any previous closure plans;
- financial provision mechanism; and
- review period for the closure and restoration/aftercare plans.

2.5.2. Closure plan introduction

The introduction section of the closure plan should provide an overview of the activity and site and the licence/permit details. Basic information should be included, such as:

- general description of the activity and site;
- date of commencement of operations;
- date of issue of first authorisation and any subsequent revisions;
- the classes of activities licensed and operational at the site;
- details of any closure requirements specified in the EPA authorisation; and
- details of any relevant requirements of planning permissions or other authorisations.

Table 2.1: Contents of a closure plan

Closure Plan Section	Section Contents
Closure plan summary	Summary details
1. Introduction	• Site description • Activities • Licence/permit details • Closure scenarios covered in the plan • Whether restoration/aftercare plan is also required
2. Site evaluation	• Operator performance • Environmental pathways and sensitivity • Site processes and activities • Inventory of buildings, plant and equipment • Inventory of raw materials, products and wastes • Maximum storage capacity for raw materials, products and wastes
3. Closure tasks and programmes	• Plant and equipment decontamination requirements • Plant and equipment decommissioning requirements • Demolition (if necessary) • Waste facility closure (e.g. landfill and extractive waste facilities) • Raw materials, products and waste disposal and/or recovery requirements • Contaminated land treatment, removal and/or disposal • Programme (Gantt chart or similar) and timeframes for delivery
4. Criteria for successful closure	• A benchmark set of criteria to evaluate the success of closure
5. Closure plan validation	• Environmental monitoring • Closure validation audit • Closure validation audit report • Closure validation certificate
6. Closure plan costing	• Plant and equipment decontamination costs • Plant and equipment decommissioning costs • Demolition costs • Waste recovery or disposal costs • Environmental monitoring costs • Site security costs • Validation costs • Management and utility costs
7. Closure plan review and update	• Proposed frequency of review • Proposed scope of review

2.5.3. Site evaluation

This section details the background information that supports the scope and content of the plan. As a minimum, this section should include the following elements:

- operator performance, to include information relating to:
  - any EMS for the activity;
  - compliance history;
  - enforcement history;
  - incident history;
  - complaint history; and
  - any relevant results of monitoring and/or site investigations carried out, which may include baseline monitoring/conditions that existed prior to the commencement of site operations (where available).

- environmental pathways and sensitivity, to include:
  - details on the underlying geology/hydrogeology;
  - proximity to surface water bodies, their classification and status;
  - proximity to sensitive receptors, including humans;
  - details on the nearest natural habitat, SAC, SPA, NHA;
  - list of all emission and discharge points, including the quantities of materials (solid/liquid/gas) emitted; and
  - neighbouring developments, etc.

The environmental sensitivity should also consider the potential pathways through which the operation may impact on the surrounding environment. It should be noted that much of the preparatory information required for this section will be available from existing information (see above).

- site processes and activities, to include:
  - overview of the processes and activities undertaken at the site;
  - detailed maps of the site and building layouts (to an appropriate scale); and
  - the different process areas, e.g. incoming raw materials, production units, dispatch area, waste handling/storage areas, water/waste water treatment areas.

Operators may find it helpful to divide the site into different areas, each of which can be addressed separately in the closure plan. It would be particularly relevant to distinguish between areas that require a closure plan only and areas that require a closure and a restoration/aftercare plan.

- inventory of buildings, plant and equipment, to include:
  - list of all buildings and major plant and equipment;
  - details of any hazardous or potentially polluting components and construction materials, e.g. PCBs, asbestos;
  - list of all bunded, secured and protected areas; and
  - details of any tests on bunds, pressure tanks, pipelines, etc.

- inventory of raw materials, products and wastes, to include:
  - a comprehensive list of all raw materials, products and waste, including non-hazardous and hazardous materials; and
  - the quantities of each item identified in the inventory.

- maximum storage capacity for raw materials, products and wastes and maximum storage amount in practice.

2.5.4. Closure tasks and programmes

This section of the report should detail the tasks necessary to achieve successful closure and provide a programme (Gantt chart or similar) for the entire closure process with all key activities included. As noted in **Section 2.5.3**, it may be helpful to divide the site into individual areas or units and address the closure of each separately. In general, it is expected that this section will outline the methods and actions necessary to address any risk of pollution and return the site to a satisfactory state. Details should include:

- plant and equipment decontamination;
- plant and equipment decommissioning;
- demolition (if necessary);
- waste facility closure (e.g. landfill and extractive waste facilities);
- raw materials, products and waste disposal and/or recovery;
- contaminated land treatment, removal and/or disposal; and
- programme (Gantt chart or similar) and timeframes for delivery.

Any specialist operations required (e.g. asbestos removal, PCB removal) should be highlighted. Proposals regarding contaminated land treatment, removal and/or disposal should include the following details:

- baseline/existing conditions;
- proposed remediation methods and their current status, including details of any agreements reached with the EPA; and
- monitoring proposals.

2.5.5. Criteria for successful closure

A benchmark set of criteria should be established in order to evaluate the success of closure. This section should provide details of the site- and sector-specific criteria used. Successful closure will be achieved when it is demonstrated that there are no remaining environmental liabilities at the site. The following are examples of benchmark criteria:

- plant safely decontaminated using standard procedures and authorised contractors;
- wastes handled, packaged, stored and disposed or recovered in a manner that complies with regulatory requirements;
- relevant records relating to waste and materials management retained throughout the closure process;
- no soil or groundwater contamination at the site verified using monitoring data and a soil and groundwater assessment at the time of closure (if required);
- hazard and/or risk of environmental pollution addressed and the EPA is satisfied that the site is returned to a satisfactory state;
- sufficient funds available to cover the full cost of closure; and
- environmental management system in place and actively implemented during the closure period.

2.5.6. Closure plan validation

This section should detail the environmental monitoring and validation provisions that will be in place, the scope and criteria for the validation audit, the qualifications and independence of the auditor and the nature of the report and closure certification resulting from the audit. It should be borne in mind that the monitoring and validation process and the resulting certification relate solely to the physical closure of the activity and that the formal acceptance of closure and ultimate surrender of a licence/permit is a separate process that must be formally agreed with the EPA. For a licence/permit to be surrendered there must be a consultation process with the EPA. The EPA will conduct a post-closure audit of the site and thereafter the EPA must be satisfied that the activity is fully compliant with its licence/permit conditions at the time of closure in order to facilitate the formal surrender or transfer of a licence/permit.

2.5.7. Closure plan costing

When costing the closure plan, operators should keep in mind that the aim is to bring a site to the point where it no longer poses any risk of environmental pollution and, where pollution has been caused, to return the site to a satisfactory state. Closure operations may require the decommissioning and decontamination of plant and equipment but may not necessarily require the removal and disposal or these items. Operators should make it clear in their closure plans what the specific intentions are towards the decommissioning and decontamination of plant and equipment and whether removal and disposal of these items is required. Similarly, there may be no need to demolish and remove buildings.

The EPA is required to ensure that 'necessary measures will be taken upon the permanent cessation of an activity (including such a cessation resulting from the **abandonment** of the activity) to avoid any risk of environmental pollution and return the site of the activity to a satisfactory state'. Accordingly, all closure costs should be included. It is not acceptable to exclude/reduce costs on the basis that closure is expected to be known in advance and quantities (e.g. of waste) will be reduced during a wind-down phase, that certain costs will be covered by the operator as part of normal operations (e.g. labour, security, management and utility costs) or that they will be off-set by assets. In addition, any additional costs if a facility closes suddenly (e.g. in the case of a landfill, additional structural works may be required if cells/phases are only partially filled) and it is necessary for third parties to complete the works should be included. Any variation to this requirement needs to be justified and supported by relevant documentation that indicates the costs will not arise.

Estimates should be prepared for all closure items and included in tabular format within this section of the report. **Table 2.2** is provided by way of guidance. It includes example items that should be considered for inclusion in the closure plan and a suggested format. **Table 2.2** is generic and should be developed further by operators to achieve a robust costing plan that is specific to each site with sufficient information to be verifiable.

Operators must determine the costs themselves from previous experience, relevant suppliers and contractors or from recognised experts who are familiar with such costs. All costs included in the plan should be site-specific, suitably referenced and verifiable. The EPA will publish unit costs separately to accompany this guidance. The EPA published unit costs are not intended to substitute for the requirement for the operator to determine costs, but are provided to assist in validating the site-specific costings.

Operators are required to include a contingency amount in their overall closure costing that is reflective of the level of uncertainty inherent in the closure calculation. Further guidance on contingency is provided in **Section 2.7.1**.

2.5.8. Closure plan review and update

A proposal for review of the closure plan should be provided. Typically closure plans must be reviewed annually and proposed amendments thereto notified to the EPA for agreement.

Table 2.2: Closure – quantification and costing template

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Unit Rates
Plant and equipment decontamination, i.e. cleaning and removal of chemical and other residues (excluding off-site waste recovery or disposal costs dealt with below)	Personnel and contractor costs	A	per day	B	= A × B	e.g. based on existing cost records
	Decontamination of chemical storage/processing unit					
	Decontamination of biological storage/processing unit					
	Decontamination of fuel storage/processing unit					
	Decontamination of abatement/treatment systems					
	Decontamination of utilities (chillers, boilers, cooling towers, generators, transformers, etc.)					
	Other decontamination					
Plant and equipment decommissioning, i.e. removal from service for plant and equipment	Personnel and contractor costs					
	Decommissioning of chemical storage/processing unit					
	Decommissioning of biological storage/processing unit					
	Decommissioning of fuel storage/processing unit					
	Decommissioning of abatement/treatment systems					
	Decommissioning of utilities (chillers, boilers, cooling towers, generators, transformers, etc.)					
	Other decommissioning					
	Transport (including loading and unloading)					
	Plant and equipment recovery or disposal					
Demolition	Any demolition works required to be carried out in order to remove any risk of environmental pollution and/or return the site to a satisfactory state					
Waste facility closure (e.g. landfill and extractive waste facilities)	Final capping					
	Installation of landfill gas infrastructure					
	Installation of leachate management infrastructure					

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Unit Rates
Minor contaminated land with no long-term liabilities (i.e. not requiring a restoration/ aftercare management plan)	Consultant costs					
	Site investigation					
	Excavation of contaminated land					
Waste recovery or disposal	Soil/stones – inert					
	Soil/stones – contaminated, non-hazardous					
	Soil/stones – contaminated, hazardous					
Note: Operators should provide the EWC code and classify each waste stream as inert, non-hazardous or hazardous and specify the proposed outlet for disposal or recovery	Sludge – uncontaminated					
	Sludge – contaminated, non-hazardous					
	Sludge – contaminated, hazardous					
	Municipal solid waste					
	Food waste					
	Mixed dry recyclables					
Note: Transport and recovery/disposal gate free to be broken out as separate line items	Paper/cardboard/packaging					
	Wood/textiles					
	Solvents/paints					
	WEEE – non-hazardous					
	WEEE – hazardous					
	Metal					
	Animal by-products					
	Waste oils					
	PCBs					
	Asbestos					
	Ash					
	Other solid wastes					
	Other liquid wastes					
	Other gaseous wastes					

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Unit Rates
Environmental monitoring	Surface water monitoring					
	Groundwater monitoring					
	Noise monitoring					
	Air monitoring					
	Gas monitoring					
	Soil monitoring					
	Leachate monitoring					
	Ecological monitoring					
	Waste monitoring					
Site security	Gates, fencing, etc.					
	CCTV					
	Security personnel costs					
Validation audit	Consultant costs					
Management and utility costs	Management					
	General administration					
	Insurance					
	Capital works management including design tendering, contract administration and site supervision					
	Overheads (utilities, services, etc.)					
Total (€)						
Contingency at ##% (€)						
Total including contingency (€)						

2.6. Preparation of the restoration/aftercare plan

2.6.1. Introduction

A restoration/aftercare period will be required where there are ongoing environmental liabilities following closure. It is expected that during the restoration/aftercare period there will be ongoing restoration/remediation works and monitoring.

2.6.2. Content

The two main circumstances[1] requiring a restoration/aftercare plan are:

- soil and groundwater contamination; and
- landform changes, e.g. landfills, extractive waste facilities, mines, quarries and soil recovery facilities.

Each of these circumstances will require a different approach in developing the site restoration/aftercare proposals. The content of the restoration/aftercare plan for the two categories is outlined in **Table 2.3** and detailed further in the following sections. Operators should adhere to relevant legislation and EPA guidance documents when preparing the restoration/aftercare plans, including:

- Best Available Techniques reference documents;
- *Landfill Manuals – Landfill Restoration and Aftercare* (EPA, 1999);
- *Environmental Management in the Extractive Industry (Non-scheduled Minerals)* (EPA, 2006);
- *Environmental Liabilities Regulations, Guidance Document* (EPA, 2011); and
- *Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites* (EPA, 2013) and associated templates.

Table 2.3: Contents of a restoration/aftercare plan

Type of Liability	Report Contents
Soil and groundwater contamination	• Site investigation and risk assessment findings • Remediation tasks and programme • Aftercare tasks and programme • Criteria for successful remediation/aftercare • Validation • Costing • Review and update
Landform changes, e.g. landfills, extractive waste facilities, mines, quarries and soil recovery facilities	• Restoration tasks and programme • Aftercare tasks and programme • Criteria for successful restoration/aftercare • Validation • Costing • Review and update

1 Restoration/aftercare plans may be required in other circumstances, e.g. some Dumping at Sea permits require an aftercare plan.

Soil and groundwater contamination

Soil and groundwater investigation and risk assessment may be required where there is evidence of soil and groundwater contamination or where there have been spillages in the past. Where contamination is detected, the operator should determine the necessary measures to be taken to avoid any risk of environmental pollution, and return the site to a satisfactory state/baseline as applicable. Where baseline information is available on the initial state of a site, this information should be used as the basis for remediation proposals. Similarly, any soil and groundwater monitoring data available from the operational phase of the activity should be accounted for in the remediation proposals. The remediation proposals should include a suitably scoped and researched contaminated land and groundwater risk assessment including recommendations and a programme of measures. Thorough investigation and remediation planning will reduce uncertainty in the remediation costing.

Where the information from investigations and risk assessment has already been submitted to the EPA, or it is intended to be submitted to the EPA, a concise synopsis should be provided with the restoration/aftercare plan. All back-up information should be fully referenced. Information provided in the restoration/aftercare plan should include:

- site investigation and risk assessment findings;
- remediation tasks and programme;
- aftercare tasks and programme;
- criteria for successful remediation/aftercare;
- costing;
- update and review; and
- validation.

Landform changes

Some activities can cause significant land changes, which will need to be restored to a suitable condition following closure. Typical examples of such activities are landfills, extractive waste facilities, mines, quarries and soil recovery facilities. Restoration includes measures such as the placement of soil or other suitable materials, landform construction, seeding, planting and other landscaping works. Restoration measures are site specific and may be incorporated into the operational phase. The process for the development of a site restoration proposal will involve the following main steps:

- details of proposed measures, land end uses and the considerations required to achieve these measures;
- details of the engineering methods and technologies, including justifications, to be employed as part of the restoration process; and
- a programme for the phased restoration of the site over a defined period of time.

2.6.3. Aftercare

Aftercare follows remediation of contaminated soil and groundwater and restoration of landfills, extractive waste facilities, etc. The principal purpose of aftercare is to ensure that the closure and remediation/restoration measures continue to be effective and achieve the overall closure and remediation/restoration goals. The measures involved in aftercare may vary from simply monitoring over a period of time to ensure that the closure and remediation/restoration measures are successful and the site is stable, to more complex ongoing pollution control measures. Examples of aftercare measures include:

- maintenance of surface water drainage systems;
- operation of contaminated soil and groundwater pump and treat systems;
- ongoing landfill gas extraction and flaring/utilisation;
- ongoing landfill leachate extraction and treatment/disposal;
- monitoring (e.g. surface water, groundwater, air, gas, leachate, stability);
- maintenance of access to monitoring locations;
- servicing and calibration of monitoring equipment (e.g. continuous water quality monitors);
- landscape maintenance of grass cover and planting;
- staff resourcing; and
- site security (e.g. CCTV, inspections/patrols, fencing).

The plan should provide a logical order of tasks and timeframes and should be based on good engineering practice and suited to the nature and scale of the activity. The objectives of the monitoring programme should be to ensure that the site does not cause environmental pollution following closure and remediation/restoration. The scope of the programme should include details of the environmental monitoring proposed and provide contingency in the event that monitoring indicates deterioration in site conditions.

2.6.4. Restoration/aftercare plan costing

Both the remediation/restoration and aftercare proposals require detailed costing by operators. The two main areas to be considered for costs are the same as those outlined above, i.e. soil and groundwater contamination and landform changes.

For sites where significant soil and groundwater contamination is present, the following items should be costed:

- site investigation works (e.g. drilling and groundwater well installation) in order to delineate the extent and magnitude of contamination;
- environmental risk assessment in order to determine whether risk is posed to environmental receptors and to devise an appropriate remediation strategy;
- implementation of a remediation programme such as excavation, treatment, environmental verification testing and/or design and installation of in-situ treatment systems;
- maintenance and monitoring costs associated with the site remediation, e.g. costs of maintenance of the treatment plant associated with a pump and treat system or the costs of groundwater monitoring associated with a monitored natural attenuation (MNA) programme;
- staff resourcing; and
- site security (e.g. CCTV, inspections/patrols, fencing).

For landform changes, the following items should be costed:

- restoration measures, e.g. backfilling, seeding and landscaping;
- maintenance of surface water drainage systems;
- ongoing pollution control measures, e.g. landfill gas extraction and flaring/utilisation, landfill leachate extraction and treatment/disposal;
- maintenance of access to monitoring locations;
- monitoring (e.g. surface water, groundwater, air, gas, leachate, stability);
- servicing and calibration of monitoring equipment (e.g. continuous water quality monitors);
- landscape maintenance;
- staff resourcing; and
- site security (e.g. CCTV, inspections/patrols, fencing).

The EPA is required to ensure that 'necessary measures will be taken upon the permanent cessation of an activity (including such a cessation resulting from the **abandonment** of the activity) to avoid any risk of environmental pollution and return the site of the activity to a satisfactory state'. Accordingly, all restoration/aftercare costs should be included. It is not acceptable to exclude/reduce costs on the basis that certain costs will be covered by the operator as part of normal operations (e.g. labour, security, management and utility costs) or that they will be off-set by assets. In addition, any additional costs if a facility closes suddenly (e.g. in the case of a landfill, additional structural works may be required if cells/phases are only partially filled) and it is necessary for third parties to complete the works should be included. Any variation to this requirement needs to be justified and supported by relevant documentation that indicates the costs will not arise.

Estimates should be prepared for all restoration/aftercare items and included in tabular format within this section of the report. **Table 2.4** is provided by way of guidance. It includes example items that should be considered for inclusion in the restoration/aftercare plan and a suggested format. **Table 2.4** is generic and should be developed further by operators to achieve a robust costing plan that is specific to each site, with sufficient information to be verifiable.

Operators must determine the costs themselves from previous experience, relevant suppliers and contractors or from recognised experts who are familiar with such costs. All costs included in the plan should be site-specific, suitably referenced and verifiable. The EPA will publish unit costs separately to accompany this guidance. The EPA published unit costs are not intended to substitute for the requirement for the operator to determine costs, but are provided to assist in validating the site-specific costings.

Operators are required to include a contingency amount to their overall restoration/aftercare costing that is reflective of the level of uncertainty inherent in the restoration/aftercare calculation. Further guidance on contingency is provided in **Section 2.7.1**.

It will be necessary to specify a minimum aftercare period in order to determine the costs of restoration/aftercare. The minimum period for the purposes of costing landfill aftercare depends on the type of waste landfilled. The leachate and gas generation potential of the waste and whether it is hazardous or not are particularly important in determining the period required. This is addressed in *Final Draft BAT Guidance Note on Best Available Techniques for the Waste Sector: Landfill Activities* (EPA, 2011). The minimum period for the purposes of costing mine/extractive waste facility aftercare is site-specific depending on the risk and is specified in licences. The long-term behaviour of the waste (e.g. whether it is acid generating) and type of closure (e.g. wet versus dry cover) are especially important factors. It should be noted that the specification of these periods and the costing of aftercare on that basis in no way relieves the operator of any excess liabilities, as specified in legislation and licence/permit conditions, should they arise during or after that period.

2.6.5. Restoration/aftercare plan review and update

A proposal for review of the closure plan should be provided. Typically restoration/aftercare plans must be reviewed annually and proposed amendments thereto notified to the EPA for agreement.

Table 2.4: Restoration/aftercare – quantification and costing template

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Information
Soil and groundwater contamination (site investigation, remediation and aftercare)	Consultants' costs	A	per day	B	= A × B	e.g. recently tendered rates
	Installation of trial pits					
	Installation of boreholes					
	Slope stability assessment					
	Excavation of contaminated soil					
	In-situ treatment of contaminated soil					
	Installation of barriers					
	Non-hazardous waste disposal costs					
	Hazardous waste disposal costs					
Landform changes (restoration and aftercare)	Seeding/planting					
	Landfill gas network operation and maintenance					
	Flare/engine operation and maintenance					
	Leachate network operation and maintenance					
	On-site leachate treatment					
	Off-site leachate transport					
	Off-site leachate treatment (gate fee)					
	Drainage maintenance					
	Pest control					
	Roads and infrastructure maintenance					

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Information
Common costs	Landscaping					
	Surface water monitoring					
	Groundwater monitoring					
	Noise monitoring					
	Air monitoring					
	Gas monitoring					
	Soil monitoring					
	Leachate monitoring					
	Ecological monitoring					
	Waste monitoring					
	Gates, fencing, etc.					
	CCTV					
	Security personnel costs					
	Management					
	General administration					
	Insurance					
	Capital works management including design tendering, contract administration and site supervision					
	Personnel/wages					
	Overheads (utilities, services, etc.)					
Total (€)						
Contingency at ##% (€)						
Total including contingency (€)						

2.7. Future proofing costs

2.7.1. Contingency

There is inherent uncertainty in costing closure and restoration/aftercare due to the complexities involved and lack of knowledge of the circumstances that will pertain at the time of closure. Therefore, the final costing should include a level of contingency. The contingency is a specific provision for unplanned or unforeseeable items (e.g. mobilisation issues due to weather conditions, changes due to incomplete design information, changes in regulatory requirements) and provides an additional level of confidence in relation to the costing.

The rate of contingency should reflect the level of uncertainty inherent in the costing. For example, there will be considerably lower uncertainty when costing contaminated land remediation if the contamination has been fully investigated, the remediation proposals have a proven track record and are agreed with the EPA versus costing when investigations are incomplete, innovative treatment methods are proposed or agreement has not been reached with the EPA. As an activity moves towards closure and restoration/aftercare, the level of uncertainty should decrease, particularly as detailed designs are developed. As a result, the level of contingency necessary may also decrease.

2.7.2. Cost profile

The closure and restoration/aftercare costs for a site may extend and vary over time. This is especially the case for phased activities, e.g. landfill cell development. The process of accounting for the closure and restoration/aftercare costs associated with phased activities can be termed the '*cost profile*' and should be clearly identified in the closure and restoration/aftercare plan, in particular for landfills and extractive waste facilities (see **Appendix A**). For such activities, the cost profile will inform the level of financial provision proposed and the model for providing financial provision over time (unless financial provision for the full closure and restoration/aftercare costs over the lifetime are to be provided up-front), and this relationship should be detailed and made clear.

2.7.3. Inflation/discounting

Closure and restoration/aftercare costs should initially be calculated and presented in today's costs, i.e. the costing at the time of the assessment. However, as the closure and restoration/aftercare costs may be incurred over a significant number of years after this initial costing is carried out and the financial provision put in place, the initial costs should be adjusted to account for future inflation. The inflation rate and justification for it should be included. The EPA may, if sufficient supporting information is available, consider further adjustment of costings to account for returns on monies held to fund liabilities.

2.7.4. Reviewing and updating costs

Closure and restoration/aftercare costs must typically be reviewed annually and proposed amendments thereto notified to the EPA for agreement. The following formula is conditioned in some authorisations and provides a framework for operators when updating costings:

$$\text{Revised Cost} = (\text{Existing Cost} \times \text{WPI}) + \text{CiCC}$$

where:

WPI = Appropriate Wholesale Price Index [Capital Goods, Building & Construction (i.e. Materials & Wages) Index], as published by the Central Statistics Office, for the year since last calculation/revision.

CiCC = Change in compliance costs as a result of change in site conditions, law, regulations, regulatory authority charges or other significant changes.

3 Incidents

3.1. Introduction

Environmental liability risk assessment (ELRA) considers the risk of incidents occurring that could result in liabilities materialising, e.g. fire, fuel spillages. Proactive environmental risk management can both increase compliance and significantly reduce the potential for an incident. The result is a lower risk profile for an activity and a potentially lower cost in making financial provision. The two key objectives of the ELRA process are:

- to identify and quantify environmental liabilities focusing on unplanned, but possible and plausible events occurring during the operational phase; and
- to provide a mechanism to encourage continuous environmental improvement through the management of potential environmental risks.

The ELRA approach is a standard risk assessment that involves the assessment of the likelihood of occurrence of an event in combination with the consequences of that event. This is followed by the costing of the plausible worst case scenario for the purposes of informing the level of financial provision (cover) necessary. The ELRA procedure is based on the standard risk assessment principles presented in the following Irish Standards:

- I.S. ISO 31000:2009 Risk Management – Principles and Guidelines; and
- I.S. EN 31010:2010 Risk Management – Risk Assessment Techniques.

The ELRA procedure is as follows:

- scoping to determine the type of environmental liabilities to be covered;
- risk assessment including the following stages:
    - risk identification, i.e. the systematic identification of plausible risks, the sensitivity of the receiving environment (receptor) and the potential pathway for the activity to impact on the environment.
    - risk analysis consists of determining the likelihood and consequences for identified risk events.
    - risk evaluation is the ranking and presentation of risks to allow for prioritisation of the risk treatment programme.
- risk treatment is a process to mitigate risks, e.g. by removing the risk or minimising the likelihood or consequences; and
- identification, quantification and costing of a plausible worst case scenario for financial provision (FP).

A broader description of each stage in the process is outlined in the following sections and the ELRA process is illustrated in **Figure 3.1**. An example ELRA is given in **Appendix B**.

ELRAs are generally required to be prepared by independent and appropriately qualified consultants. Operators should examine relevant conditions of their authorisations in this regard. Given that this is a complex and relatively emerging area, the use of external expertise is important in bringing broad

experience to bear. However, it is also important that relevant operator staff are fully part of the ELRA process so that it is additionally informed by site-specific knowledge. In combination, this should ensure a rigorous process and that the ELRA meets the standards required here.

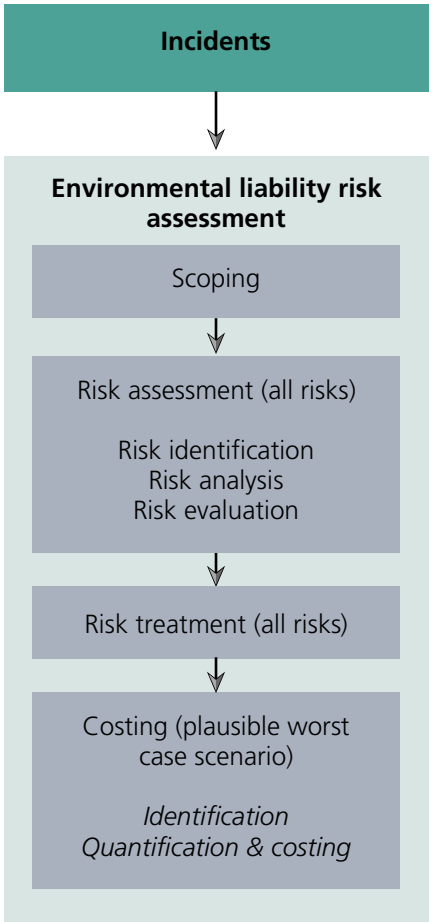

Figure 3.1: Environmental liability risk assessment process

3.2. Scoping

The scope of the environmental liabilities to be covered in the ELRA is dependent on the activity. The precise wording of authorisation conditions should be identified and used to set the context for the ELRA process and should be stated in the scoping section of the ELRA report. For example, a typical IPPC licence condition requires the ELRA to *address liabilities from past and present activities* whereas a typical WWD authorisation condition requires the ELRA to *address liabilities from present or planned discharges*. The difference in the context here requires the IPPC operator to address all environmental risks relating to the operation whereas the WWD operator must address the risks from discharges from the agglomeration.

The purpose of ELRA is to identify and cost risks to the environment (surface water, groundwater, atmosphere, land, flora, fauna and human health). It should not include risks solely relating to health and safety, e.g. direct injury or death resulting from vehicular collisions. Also, the analysis and costing should cover the environmental aspects of an event, e.g. stopping it, preventing further emissions/pollution, clean-up of emissions/pollution caused. It should not include other costs that, though associated, are non-environmental, e.g. legal fees/penalties and business interruption.

3.3. Risk assessment

3.3.1. Risk identification

A list of risks for the activity must be identified focusing on plausible incidents.

The term 'incident' generally refers to a change of circumstances from the norm with actual or potential negative consequences. The IED refers to incidents and accidents, but for the purposes of this guidance the term 'incident' only is used and is taken to include accidents within its meaning. The following are typically defined in EPA authorisations as incidents:

- an emergency;
- an abnormal operation;
- a breakdown;
- any emission/discharge that does not comply with the requirements of an authorisation;
- any exceedance of the daily duty capacity of waste handling equipment;
- any trigger level that is attained or exceeded;
- any indication that environmental pollution has, or may have, taken place;
- any loading or dumping activity that does not comply with the requirements of an authorisation (Dumping at Sea); and
- an incident with the potential for environmental contamination of surface water or groundwater or posing an environmental threat to land or requiring an emergency response by the relevant water services authority (Waste Water Discharge Authorisations).

In identifying what is plausible, account should be taken of the controls and mitigating measures in place but with due regard for the capacity of the controls to contain incidents and for the potential failure of the controls. For example, literature indicates that bund overtopping, albeit highly unlikely, is plausible in the event of catastrophic tank failure. Seveso-related guidance states that 50% bund overtopping is typically assumed for calculations used in that context in relation to pool fires. So the risk identified in relation to a standard bunded tank might be described in terms of a 50% loss of the tank contents to the environment. This risk (and others identified) is then carried forward through the remaining steps of the ELRA process (analysis, evaluation, treatment). It may also be the risk used for costing if it is the overall plausible worst case scenario for the site. However, for an equivalent unbunded tank, the plausible scenario would be 100% loss.

In order to establish fully a set of risks for an activity, details on the site operation, operator performance and environmental sensitivity should be collated and reported at the initial stage of the risk identification process. **Table 3.1** presents a list of the information that should be summarised in the ELRA report to allow for validation of the risk identification stage.

Table 3.1: Key information required for the risk identification process

Parameter	Data Requirement
Site Operation	• Size and nature of the activity • Age of the activity and previous site uses • Details of licence/permit • Overview of site infrastructure • Details on storage and handling of fuel and other materials • Details on the scale and nature of all environmental emissions • Overview of abatement plant • Overview of the nature and volumes of waste generated
Operator Performance	• Environmental Management Systems • Compliance history • Enforcement history • Incidents history
Environmental Sensitivity	• Details on the underlying geology/hydrogeology, coupled with any historic soil or groundwater monitoring or known contamination • Proximity to identified surface water bodies, their Water Framework Directive status and identification of scheduled or unscheduled discharges to these water bodies from the activity • Proximity to sensitive human receptors and potential for nuisance or health impacts to these receptors • Details on the nearest EU or National protected site, natural habitat or protected species and potential pathways for the activity to impact these habitats and species

This information on the site operation, performance and sensitivity is critical to the risk identification process. Valuable sources of information for this scoping stage include:

- planning and EIA documentation;
- licence/permit application form and attachments;
- AER;
- EMS;
- RBME inputs for IED, IPPC and waste activities;
- DREAM inputs for waste water discharges;
- national environmental mapping databases from the EPA, National Parks and Wildlife Service, Geological Survey of Ireland, etc.; and
- other sources (e.g. HSA risk assessments, Seveso reports, appropriate assessments).

A suggested method of carrying out the risk identification stage is to initially identify all the processes, list the risks associated with each process, identify potential causes of failure of the processes and identify the effects or impacts on the environment. Comprehensive identification of risks is critical to ensure that all risks are identified and addressed in the risk analysis stage.

A risk management workshop should be held with the relevant personnel and external experts as necessary to identify the plausible risks inherent in the activity. A list of generic cross-sector risks is provided for guidance in **Table 3.2** and a series of sector-specific risks are provided for guidance in **Table 3.3**. These tables are not exhaustive, nor will all of the risks will apply to all activities. Operators must include all risks pertinent to the activity.

Table 3.2: Generic risks for all sectors

Process	Potential Risk
Fuel Storage	Fuel spillage during tanker unloading/delivery operations
	Loss from above-ground tanks/pipelines, discharge to surface water
	Loss from above-ground tanks/pipelines, groundwater and/or soil contamination
	Loss from above-ground tanks/pipelines, discharge to WWTP
	Loss from underground tanks, groundwater and/or soil contamination
	Loss from underground pipelines, groundwater and/or soil contamination
Bulk Storage and Handling (chemicals, solvents, milk, etc.)	Spillage during tanker unloading/delivery operations
	Loss from bulk storage tanks, discharge to surface water
	Loss from bulk storage tanks, groundwater and/or soil contamination
	Loss from bulk storage tanks, discharge to waste water treatment plant (WWTP)
	Loss from pipelines
	Leak from intermediate bulk containers (IBC)/drums during storage or handling
	Storage of incompatible chemicals
Production	Process explosion leading to discharges to air, water and/or soil
	Other spillages from production
	Mixing of incompatible chemicals
Weather	Flooding on the site causing uncontrolled discharge
	Impact to process and abatement of extreme cold temperatures
	Power failure
Waste Management Practices	Errors in waste classification/labelling, particularly hazardous waste classification
	Leaching from waste storage, impact on surface water, groundwater and/or soils
	Spillages/leaks of waste oil in process areas
	Breach of waste bund capacity, impact on surface water, groundwater and/or soils
	Non-hazardous waste contaminated with hazardous waste
Air Abatement Systems	Emissions due to poor combustion in incinerator
	Burning of unauthorised material in incinerator
	Losses from incinerator ash storage and handling
	Failure of abatement, release of unabated emissions to atmosphere
	Thermal oxidiser bypass and emissions to atmosphere
	Failure of the monitoring/control system on the emission point
Drainage Network	Excessive loss of suspended solids to surface water network
Water Treatment Systems	Losses and overflows from above-ground tanks and pipelines
	Losses and overflows from underground tanks and pipelines
	Unscheduled or shock load discharge from production disrupting treatment process
	Non-compliant discharge from treatment plant to municipal sewer
	Non-compliant discharge from treatment plant to surface water
Fire	Fire – emissions to air, fire water discharge to sewer, surface water or groundwater
Traffic	Loss to environment due to incidents involving vehicles (forklifts, trucks, etc.)
Legacy	PCB-containing equipment, potential for leakage
	Asbestos-containing material
	Historical groundwater or soil contamination

Table 3.3: Sector-specific risks

Sector	Process	Potential Risk
Urban Waste Water Treatment Plants	Discharge	Non-compliant collection network discharges
		Failure of inlet works and overloading to receiving waters
		Failure of aeration tank and discharge of untreated waste water
		Failure of clarifier and discharge of elevated solids to receiving waters
		Failure of effluent monitoring system and uncontrolled discharge
		Power failure at the WWTP resulting in prolonged and uncontrolled discharge
Dumping at Sea	Loading Operation	Collision leading to discharge to surface water
		Uncontrolled or poorly controlled release during loading or plough dredging – impact on marine environment
	Unloading Operation	Collision leading to discharge to surface water
		Unloading carried out at incorrect location
		Uncontrolled or poorly controlled release during unloading – impact on marine environment
Landfill	Landfill Operations	Landfill fire causing the release of fugitive air emissions
		Landfill fire causing damage to the liner, impact on groundwater and/or soil
		Damage to liner during filling of cells, impact on groundwater and/or soil
	Landfill Gas Management	Escape of landfill gas to the atmosphere, failure of the flare/gas control
		Landfill gas migration and accumulation in structures on/off site
	Leachate Management	Leachate escaping from unlined cells. Contamination of groundwater/soil/surface water from leachate
		Leachate tanks and lagoons rupturing and entering surface water and groundwater
		Overflow of leachate from cells
		Leachate breakout/leakage due to breach in liner
		Silt clogging pumps resulting in leachate build-up and release
		Traffic accidents within the site during the tankering of leachate, resulting in loss of leachate to groundwater/soil/surface water
		Traffic accidents during off-site disposal of leachate, resulting in loss of leachate to groundwater/soil/surface water
		Failure of pipeline connections, joints, tees, etc. resulting in the release of leachate and groundwater/ soil/surface water contamination
		Leachate being unsuitable for treatment at WWTP
	Landfill Capping	No capping in place and subsequent impact
		Degradation of capping
		Breach of capping system

3.3.2. Risk analysis

Risk analysis commences with the establishment of risk classification criteria followed by risk analysis based on these criteria. Risk classification tables are required in order to evaluate and rank the risks compared with each other. They form the basis for rating the likelihood of an event occurring and the consequence of impact if the event occurs. The likelihood and consequence ratings are combined to form a risk score for risk evaluation (see **Tables 3.4 to 3.7**). Tables 3.4 and 3.5 are given by way of example and operators may develop the descriptors in particular, which could be based on case-specific numeric information.

Guidance is provided on a range of risk assessment techniques referenced in I.S. EN 31010:2010, and operators should refer to this standard for greater detail.

The risks identified should be tabulated in tailored risk assessment forms and assessed in terms of likelihood and consequence using the risk classification tables. A template risk analysis form is provided in **Table 3.6**, which includes one risk item for illustration. Refer to **Appendix B** for a complete example.

Table 3.4: Risk classification table – likelihood

Rating	Likelihood	
	Category	Description
1	Very Low	Very low chance of hazard occurring
2	Low	Low chance of hazard occurring
3	Medium	Medium chance of hazard occurring
4	High	High chance of hazard occurring
5	Very High	Very high chance of hazard occurring

Table 3.5: Risk classification table – consequence

Rating	Consequence	
	Category	Description
1	Trivial	No impact or negligible change to the environment
2	Minor	Minor impact/localised or nuisance
3	Moderate	Moderate impact to environment
4	Major	Severe impact to environment
5	Massive	Massive impact to a large area, irreversible in medium term

Table 3.6: Risk analysis template (with example extracted from Appendix B)

Risk ID	Process	Potential Risks	Environmental effect	Consequence Rating	Basis of Consequence	Likelihood Rating	Basis of Likelihood	Risk Score (Consequence × Likelihood)
4	Milk Storage and Handling	Loss from bulk storage tanks/ pipelines – discharge to surface water	Contamination of surface water.	4	Large volume loss. Potential for fish kill. Non-hazardous and not persistent	4	Tanks are in bunded locations. Tanks, bunds and pipelines infrequently inspected and tested. Level alarms installed. High number of tanks subject to ongoing use.	16

3.3.3. Risk evaluation

The purpose of risk evaluation is to assist in making decisions, using the outcomes of the risk analysis, identifying and prioritising the risks for risk treatment. Each of the risks is ranked to assist in the prioritisation of treatment. A template risk evaluation form is provided in **Table 3.7** showing one risk item for illustration.

Table 3.7: Risk evaluation template (with example extracted from Appendix B)

Risk ID	Process	Potential Risk	Consequence Rating	Likelihood Rating	Risk Score
4	Fuel Storage	Loss from bulk storage tanks/pipelines – discharge to surface water.	4	4	16

A risk matrix can be developed to allow the risks to be easily displayed and prioritised (see **Table 3.8** and example in **Appendix B**). The consequence and likelihood ratings are used in the matrix with the level of consequence forming the **x**-axis and the likelihood forming the **y**-axis. The matrix is colour coded to provide a broad indication of the critical nature of each risk. The matrix provides a visual tool for regular risk reviews since the success of mitigation can be easily identified.

Table 3.8: Risk matrix template (with example extracted from Appendix B)

Likelihood	**V. High**	**5**					
	High	**4**				**4**	
	Medium	**3**					
	Low	**2**					
	V. Low	**1**					
			1	**2**	**3**	**4**	**5**
			Trivial	**Minor**	**Moderate**	**Major**	**Massive**
					Consequence		

3.4. Risk treatment

The risk treatment process involves the identification and prioritisation of management and mitigation measures to mitigate risks identified in the risk evaluation process, e.g. by removing the risk or minimising the likelihood or consequences. The output of the risk treatment stage is a *Statement of Measures* taken or adopted in relation to the prevention of impact to the environment.

A risk owner (such as the engineering manager, environmental manager, etc.) should be allocated to each risk. This person should be responsible for the ongoing management of that risk and the implementation of risk mitigation measures. Timeframes should be allocated for the implementation of each risk mitigation measure. A template risk treatment Statement of Measures is illustrated in **Table 3.9**, showing one risk for illustration.

Monitoring and review of the risk assessment process should be carried out to verify continuous improvement in the risk profile of an operation. This ongoing review will also facilitate the inclusion of new risks and the updating of existing risks based on implemented risk treatment. At a minimum the ELRA process should be conducted every three years in line with the licence/permit requirements, but reviews should be carried out on a more regular basis in the event of major infrastructural changes on site or in light of incident investigation. All aspects of the ELRA management process should be recorded and traceable to ensure transparency in the decision-making process.

Table 3.9: Statement of measures template (with example extracted from Appendix B)

Risk ID	Potential Risk	Risk Score	Mitigation Measures to be taken	Outcome	Action	Completion Date	Contact Person
4	Loss from bulk storage tanks/ pipelines – discharge to surface water.	16	Increase tank and bund integrity assessment to annual frequency.	Increased tracking of potential faults in tank/ bund structure.	Contract structural engineer to carry out works.	Immediate	Manager

3.5. Costing

This section details the approach for calculating the level of financial provision (cover) required in relation to the risks identified by the ELRA process. The methodology for costing the level of financial provision necessary is based on costing the plausible worst case scenario.

3.5.1. Identification of the plausible worst case scenario

The plausible worst case scenario refers to the plausible event that poses the maximum environmental liability, i.e. consequence, during the period to be covered by the financial provision.

The plausible worst case scenario may be represented by the risk with the highest consequence rating. In that case, this risk should be the basis for financial provision and should be quantified and costed as detailed below. Where two or more risks are identified as having the maximum consequence, further analysis should be undertaken to identify the most significant of these for quantification and costing.

There may be links/domino-effects between individual risks, in which case a number of risks may need to be grouped to represent a plausible worst case scenario. Refer to the example in **Appendix B** for a worked example of this approach.

The likelihood is **not taken** into account in this analysis. Once a risk is considered plausible, it must be included in the risk assessment and the level of financial provision is based on the consequences alone.

3.5.2. Quantification and costing

For the plausible worst case scenario, operators are required to complete a detailed quantification and cost analysis. The first step in this process is to provide a detailed description of the plausible worst case scenario in terms of the expected losses to the environment as follows:

- The types of materials lost;
- The quantity of materials lost;
- The pathways involved;
- The nature and extent of impact;
- The control and remediation measures required.

The scenario should then be costed. The following criteria apply to the costing:

- The costs presented should be based on the control measures in place at the time of reporting. Planned mitigation measures cannot be included in the risk assessment or calculation until these measures have been fully implemented;
- Operators are required to present this information in sufficient detail to demonstrate a high level of confidence in the calculated costs;
- Operators may add additional line items as required to demonstrate as much key information as possible.
- For each cost item provided by the operator, a rationale for this cost must be provided. This rationale must be based on real, current cost estimates for the activity and the sources of the costs must be provided. The EPA will publish unit costs separately to accompany this guidance. The EPA published unit costs are not intended to substitute for the requirement for the operator to determine costs, but are provided to assist in validating the site-specific costings.
- A contingency fee shall be applied to the subtotal to allow for uncertainty in the cost estimate. This amount of the contingency fee should reflect the level of uncertainty in the detail provided.

A template is provided in **Table 3.10**; refer to **Appendix B** for a detailed example. The use of any alternative methodology for calculating the cost of the plausible worst case scenario should be agreed in advance with the EPA.

Operators should note that environmental incidents, even involving relatively low-risk activities and relatively low losses to the environment, can result in high costs. Operators should be cognisant of the requirements under the Environmental Liability Directive (2004/35/EC) for not only primary remediation, but also compensatory and complementary remediation where necessary. This may have a significant bearing on incident-related costs.

Some information on costs associated with past incidents is provided in **Appendix C.** Based on this information, the EPA expects that minimum costs determined by ELRA for EPA-authorised activities should be €1,000,000, with higher amounts for higher risk activities.

3.6. Outcomes and next steps

Implementation of the results of the ELRA should be reported to the EPA annually through a statement of measures. The ELRA should be reviewed as necessary to reflect any significant changes on site, and in any case every three years.

Table 3.10: Plausible worst case scenario – quantification and costing template

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost	Source of Unit Rates
Total (€)						
Contingency at ##% (€)						
Total including contingency (€)						

Appendix A

Example closure and restoration/aftercare plan

Note: This example is provided for guidance to indicate the key points of the process and report. It does not reflect the full complexity of a closure and restoration/aftercare plan for such an activity in reality.

Summary

Activity Details

- Name: ABC Pharmaceuticals
- Address: Baile Mór, An Cathair, Ireland.
- Licence/Permit Number: P0XXX-03
- Activities licensed:
  - 5.16 Chemicals – The use of a chemical or biological process for the production of basic pharmaceutical products.
  - 11.1 Waste facility – The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required.

- RBME Category: B3 Year: 2012

Report Preparation

The report was prepared on behalf of the operator by XYZ Environmental Consultants.

- Address: XYZ Environmental Consultants,
  An Cathair, Ireland.

Comparison with Previous Plans

Two previous closure/restoration plans were submitted for 2007 and 2010, as summarised below:

Year	Closure and Restoration/ Aftercare Cost	Financial Provision	Expiry Date of Financial Provision
2013	€2,792,370	Bond	2016 (proposed)
2010	€2,500,000	Bond	2013
2007	€2,450,000	Bond	2010

Note: Figures include contingency and are adjusted for inflation.

Overview of the Plan

The closure and restoration/aftercare plan was prepared in accordance with Condition 10 of the IPPC Licence. The methodology for the development of the closure and restoration/aftercare plan follows the EPA *Guidance on assessing and costing environmental liabilities* (2013) and has been prepared by an independent and appropriately qualified consultant.

Scoping

Scoping has determined that the site will have long-term liabilities (primarily legacy issues from the landfill). As such, a closure plan and a restoration/aftercare plan have been prepared.

Cost Summary

The total closure and restoration/aftercare costs have been calculated as **€2,792,370** (including contingency and adjusted for inflation).

Financial Provision

ABC Pharmaceuticals has made the necessary financial provision to cover this by means of a bond submitted under separate cover to the EPA.

Review

This closure and restoration/aftercare plan will be reviewed annually and any updates will be notified to the EPA.

1.0 Introduction

Site Description

The site has an area of 24 hectares and is located in Baile Mór, four kilometres from An Cathair. The site is bordered to the south by agricultural lands and the east by the River Abhann. An Cathair is to the north of the site.

The site employs 150 full-time staff and operates 24 hours, seven days a week.

Commencement of Operations

The company acquired the site in 1994. The previous owner had operated at the activity from 1984 to 1994 using a similar process.

The EPA issued IPPC licence P0XXX-01 in 1995. The licence has subsequently been updated twice. The current IPPC licence is P0XXX-03.

Classes of Activity Licensed

Activities licensed are:

- 5.16 Chemicals – The use of a chemical or biological process for the production of basic pharmaceutical products.
- 11.1 Waste facility – The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required.

The latter relates to an on-site historical landfill.

Licence Requirements

This closure and restoration/aftercare plan includes the proposed closure and decommissioning of the production facility and associated infrastructure as well as the restoration/aftercare of the on-site landfill. Condition 10 of the IPPC licence outlines the requirement for a closure and restoration/aftercare plan:

> *The licensee shall prepare, to the satisfaction of the Agency, a fully detailed and costed plan for the decommissioning or closure of the site or part thereof. This plan shall be submitted to the Agency for agreement.*
>
> *The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER. No amendments may be implemented without the agreement of the Agency.*

This report has been prepared to satisfy this condition of the IPPC licence. The methodology for the development of the closure and restoration/aftercare plan follows the EPA guidance.

Condition 10 of the IPPC licence states that as a minimum the closure and restoration/aftercare plan shall contain the following:

(i) *a scope statement for the plan;*

(ii) *the criteria that define the successful decommissioning of the activity or part thereof, which ensures minimum impact on the environment;*

(iii) *a programme to achieve the stated criteria;*

(iv) *where relevant, a test programme to demonstrate the successful implementation of the decommissioning plan; and*

(v) *details of the costings for the plan and the financial provisions to underwrite those costs.*

This closure and restoration/aftercare plan will focus on the planned and/or anticipated liabilities associated with closure and restoration/aftercare and the required financial provisions required for these liabilities.

2.0 Site Evaluation

Operator Performance

The operator maintains an EMS with full ISO 14001 accreditation which complies with Condition 2.2 of the IPPC licence. The operator has also recently applied for EMAS accreditation which it is hoped will be awarded next year. These systems are regularly audited and renewed. A key benefit of operating an EMS is to encourage a review of all processes on a site and their impact on the environment, and the assessment of how these impacts can be reduced. The operator maintains a system of continuing improvement and strives to ensure it meets all environmental commitments and licence conditions.

There were no environmental complaints in relation to the activity for the reporting period of 2012.

There were two significant environmental incidents reported since the licence was issued:

- One incident was in relation to a spillage of isopropyl alcohol (IPA) during a delivery adjacent to the chemical store. Although extensive, the spillage was contained and immediately cleaned up. An investigation was carried out and corrective actions have been implemented.
- The second was a spillage in the fuel storage area resulting in contaminated land. This was investigated and remediated. Contaminated soils were excavated and removed for disposal off site.

Apart from the above, the only non-compliance issue relevant to closure relates to the failure to place a final cap on the landfill. This is addressed in this closure and restoration/aftercare plan.

The following investigations were carried out at the site as part of the IPPC licence application and following the granting of the IPPC licence.

- A hydrogeological investigation report outlining the existing soil and groundwater conditions at the site was completed following the grant of the IPPC licence in 1994. The report identified no contamination at the site.

The following monitoring takes place in accordance with the conditions of the IPPC licence:

- The activity operates an activated sludge waste water treatment plant (WWTP) to treat water used in processing and sanitary waste water. The effluent is treated before being discharged to the River Abhann. Monitoring of the final discharge is carried out on a daily composite basis. The final discharge from the WWTP achieved 100% compliance in 2012.
- Groundwater quality is monitored through a series of boreholes on a quarterly basis. Since the monitoring programme began, the results have shown satisfactory groundwater quality.
- Air emissions arise primarily from the liquid/vapour incinerator. The incinerator emissions include volatile organic compounds (VOC), nitrogen oxides (NO_x), oxides of sulphur (SO_x) and particulates. Emissions from the incinerator achieved 100% compliance in 2012.

Environmental Pathways and Sensitivity

The bedrock geology underlying the site is Waulsortian limestones and is classified as a Regionally Important Aquifer (Rkd) – Karstified (diffuse). The groundwater vulnerability is classified as Moderate (M). The River Abhann lies to the east of the site. Storm water run-off from hard-standing areas and surface water run-off are discharged to the River Abhann at SW1 and SW2. The water quality at both of these locations has been classified by the EPA as 'Good' with an EPA Q value of Q4. Process waste waters are directed to the site's on-site waste water treatment plant before discharging to the River Abhann at outfall location SW3.

There are no National Heritage Areas (NHA), proposed National Heritage Areas (pNHA), Special Areas of Conservation (SAC) or Special Protection Areas (SPA) within 1 km of the site. The site is located south of An Cathair, which is the nearest built-up area. The nearest residential receptors are located along the western boundary. Site buildings and activities are approximately 100 m from the nearest properties. Table A1 provides details of the licensed emission points.

Table A1: Licensed emission points

ID No.	Emission	Destination of Emission (e.g. air/water/soil)	Location	
			Easting	Northing
SW1	SW discharge to River Abhann	Water	123456	123456
SW2	SW discharge to River Abhann	Water	123455	123455
SW3	WWTP discharge to River Abhann	Water	123454	123454
A2-1	Liquid vapour incinerator (LVI)	Air	654321	654321

Activity Processes and Activities

The activity manufactures bulk active pharmaceutical ingredients and intermediates at two manufacturing plants. The activity also has an on-site waste water treatment plant, a solvent recovery facility, a utilities generation plant and a liquid incinerator.

The production buildings are designed to manufacture a range of bulk active pharmaceutical ingredients (API) and some intermediates, which are then exported to other plants for the production of final dosage forms.

Raw materials are held in the solvent tank farm and storage warehouses and fed into the production buildings on an 'as needed' basis. All waste materials are extracted via vent hoods to the liquid vapour incinerator (gas wastes), transferred into the solvent recovery unit (solvent liquid waste) for recycling, segregated and recycled, fed into the incinerator (waste solvent not suitable for recovery) or sent off-site for disposal to an appropriately authorised facility.

The activity historically operated a landfill which ceased receiving waste in 2006. These cells contain inert waste from historic construction operations at the plant. All five cells have been temporarily capped.

A map of the site is provided in Attachment __ of this plan.

Inventory of Buildings, Equipment and Plant

The site consists of the following:

- Production building 1
- Production building 2
- Warehouses
- Main facilities buildings (boilers, chillers, etc.)
- Waste storage facility
- Solvent recovery facility and tank farm
- Solvent tank farm
- Caustic tank
- Waste solvent tank farm
- WWTP
- Liquid vapour incinerator (LVI)
- Fuel tank farm
- Stormwater retention pond
- Contractor compound
- Landfill (ceased)

There is no asbestos or PCBs contained in the buildings or plant located on site.

Inventory of Raw Materials, Product and Waste

Table A2 provides an inventory of raw materials, products and waste stored on site. A comprehensive inventory of raw materials, fuels and waste broken down by individual type is provided in Attachment __.

Table A2: Inventory of raw materials, products and waste

Type	Storage Area	Storage Type	Maximum Storage Capacity	Measurement Unit
Various	Raw Material Warehouse	IBC/drums	15,000	litres
Solvents	Tank Farm 1	8 Tanks	304,000	litres
Caustic	Caustic Tank	1 Tank	80,000	litres
Fuel	Fuel Tank Farm	3 Tanks	15,000	litres
Solvents	Solvent Recovery Tank Farm	6 Tanks	96,000	litres
Solvent Waste	Waste Solvent Tank Farm	6 Tanks	240,000	litres
Waste	Waste Storage Area (Non-hazardous)	Skips	700	tonnes
Waste	Waste Storage Area (Hazardous)	Drums	100	tonnes
Sludge Waste	Waste Water Treatment Plant	Container	100	tonnes
C&D Waste	Landfill	Landfill	50,000	tonnes

3.0 Closure Tasks and Programmes

This section will focus on the closure aspects of the activity. The restoration/aftercare aspects are considered further in **Section 8** of this plan.

The closure plan includes the decommissioning and decontamination of all of the above- and below-ground structures and the management and safe removal of any residuals arising as a result of decommissioning.

The purpose of the closure process is to ensure that the site no longer poses a risk of environment pollution. It is not envisaged that any of the plant and/or equipment will have to be demolished. These elements, once decommissioned and decontaminated, will be tested to ensure there is no risk of environmental pollution remaining. The following steps will be carried out in sequential order to achieve closure of the production area of the site:

- Decontamination and decommissioning of production buildings using standard clean in place (CIP) procedures. All wash waters discharged to WWTP for treatment. All residual waste and materials removed to waste storage areas.
- Emptying of warehouses and decontamination of warehouse buildings. Material returned to supplier, where possible, or labelled and dispatched to waste storage areas.
- Emptying, decontamination and decommissioning of solvent, caustic and fuel tank farms. No residuals to remain in tanks or pipelines. Residuals to be treated on-site or recovered/disposed of off-site at appropriate facilities.
- Shutdown, decontaminate and decommission boilers. Residual fuels to be removed from tanks and pipelines.
- Decommission chiller units and cooling towers.
- Shutdown and decommission contractors' compound. Removal of all residual waste to waste storage areas.

- Decontaminate and decommission laboratories. Removal of all residual waste to waste storage areas.
- Clear and clean all office and administration areas. WEEE to be removed by suitably permitted operator. All other wastes to be dispatched to waste storage areas.
- All wastes to be segregated, labelled and removed for waste recovery/disposal by suitably permitted operator. Clear and decontaminate waste storage areas.
- Rinse through process and foul water drainage networks to WWTP. Pump any residual process water from sumps and lift station to WWTP.
- Clean silt trap and interceptor in the surface water network.
- Decontaminate and decommission WWTP.
- Landfill – final capping, installation of drainage infrastructure and installation of monitoring infrastructure (landfill restoration/aftercare is addressed in **Section 8**).

It is estimated that full closure will take 12 months to complete following shut-down. Suitably qualified sub-contractors will be contracted to handle hazardous materials or specialist operations. A programme for the closure works (in Gantt chart format) has been included in Attachment __.

4.0 Criteria for Successful Closure

The following criteria have been established to set the benchmark for the successful closure of the site.

- Plant safely decontaminated using standard procedures and authorised contractors;
- Wastes handled, packaged, stored and disposed or recovered in a manner that complies with regulatory requirements;
- Relevant records relating to waste and materials management retained throughout the closure process;
- No soil or groundwater contamination at the site, verified using monitoring data and a soil and groundwater assessment at the time of closure (if required);
- Hazard and/or risk of environmental pollution addressed and the EPA is satisfied that the site is returned to a satisfactory state;
- Sufficient funds available to cover the full cost of closure; and
- Environmental management system in place and actively implemented during the closure period.

5.0 Closure Plan Validation

Upon completion of implementation of the closure plan, the operator will conduct a validation audit to demonstrate to the EPA that the closure plan has been implemented. The qualification and experience of the independent auditor will be provided and agreed with the EPA prior to the validation commencing. The scope of the validation audit will be agreed in advance with the EPA and following approval, the chosen independent auditor will complete the validation audit. The completed validation audit report will be submitted to the EPA for approval.

6.0 Closure Plan Costing

The estimated costs associated with the closure plan implementation are outlined in Table A3. The closure requirements and costs for this activity are well defined, relatively straightforward and not subject to a large number of unknowns. In that context, a contingency of 20% is considered appropriate and is provided to allow for unplanned or unforeseeable items.

7.0 Closure Plan Update & Review

In accordance with the IPPC licence, *'the plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement'*. The operator commits to reviewing the closure plan on an annual basis and updating to reflect any significant alterations on site.

Table A3: Closure costing

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Plant and equipment decontamination, i.e. cleaning and removal of chemical and other residues (excluding off-site waste recovery or disposal costs dealt with below)	**Production Building 1** – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	40	day	1,750	70,000	ABC Cleaners
	Production Building 2 – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	20	day	1,750	35,000	ABC Cleaners
	Raw Material Warehouse – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	5	day	1,750	8,750	ABC Cleaners
	Boilers	2	unit	3,000	6,000	Boilers Inc.
	Tank Farm 1 – 8 × 38,000 litre tanks	8	unit	5,500	44,000	DC Ltd
	Caustic Tank – 1 × 80,000 litres	1	unit	8,000	8,000	DC Ltd
	Fuel Tank Farm – 3 × 5,000 litres	3	unit	3,300	9,900	DC Ltd
	Solvent Recovery Tank Farm – 6 × 16,000 litres	6	unit	3,500	21,000	DC Ltd
	Waste Solvent Tank Farm – 6 × 40,000 litres	6	unit	7,000	42,000	DC Ltd
	Waste Storage Areas - Cleaning contractor personnel costs (1 supervisor, 3 operatives)	1	day	1,750	1,750	ABC Cleaners
	Process drain jetting – 300–600 mm	8,500	m	2.00	17,000	QC Drains
	WWTP – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	5	day	1,750	8,750	ABC Cleaners

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Plant and equipment decommissioning, i.e. removal from service for plant and equipment	**Production Building 1** – Decommissioning contractor personnel costs (1 supervisor, 3 operatives)	40	day	2,500	100,000	DC Ltd
	Production Building 2 – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	20	day	2,500	50,000	DC Ltd
	Raw Material Warehouse – Cleaning contractor personnel costs (1 supervisor, 3 operatives)	5	day	2,500	12,500	DC Ltd
	Boilers	2	unit	7,000	14,000	DC Ltd
	Chillers	3	unit	5,000	15,000	DC Ltd
	Cooling Towers	1	unit	6,000	6,000	DC Ltd
	Tank Farm 1 – 8 × 38,000 litre tanks	8	unit	9,000	72,000	DC Ltd
	Caustic Tank – 1 × 80,000 litres	1	unit	16,000	16,000	DC Ltd
	Fuel Tank Farm – 3 × 5,000 litres	3	unit	3,000	9,000	DC Ltd
	Solvent Recovery Tank Farm – 6 × 16,000 litres	6	unit	4,500	27,000	DC Ltd
	Waste Solvent Tank Farm – 6 × 40,000 litres	6	item	9,000	54,000	DC Ltd
	Liquid Vapour Incinerator	1	item	20,000	20,000	DC Ltd
	WWTP – Decommissioning contractor personnel costs (1 supervisor, 3 operatives)	5	day	2,500	12,500	DC Ltd
Plant disposal	**Transport** (assumes 100 km round trip and 20 tonne loads)	4,000	tonne	40	160,000	Metal Hauliers
	Recovery (note nil cost)	4,000	tonne	0	0	Metal Recovery Ltd
Landfill closure (restoration/ aftercare dealt with below)	**Final capping** (200 mm regulating layer, 650 mm subsoil layer and 150 mm topsoil)	10,000	m^2	15	150,000	Landfill Engineering Ltd
	Installation of drainage network	800	m	10	8,000	Landfill Engineering Ltd

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Waste disposal/recovery (non-hazardous)	**Waste Solvent Tank Farm** – 6 × 40,000 litres (gate fee)	240	tonne	250	60,000	Pharmachem Waste Ltd
	Waste Solvent Tank Farm – 6 × 40,000 litres (transport)	240	tonne	50	12,000	Bulk Transport Inc.
	Waste Storage Area – non-hazardous waste (gate fee including levy)	700	tonne	110	77,000	Landfill Ltd
	Waste Storage Area – non-hazardous waste (transport)	700	tonne	30	21,000	Bulk Transport Inc.
	Waste Storage Area – hazardous waste (gate fee)	100	tonne	150	15,000	Hazardous Waste Management Ltd
	Waste Storage Area – hazardous waste (transport)	100	tonne	70	7,000	Bulk Transport Inc.
	WWTP sludge (gate fee)	100	tonne	150	15,000	Incinerator Ltd
	WWTP sludge (transport)	100	tonne	30	3,000	Bulk Transport Inc.
	Residual fuels from decontamination stage (transport/disposal/recovery)	50	tonne	130	6,500	Residuals Management Ltd
	Residual solvents from decontamination stage (transport/disposal/recovery)	5	tonne	300	1,500	Residuals Management Ltd
	Interceptor sludge (transport/disposal/recovery)	1	tonne	140	140	Residuals Management Ltd
Environmental monitoring	**Surface water monitoring** (2 locations quarterly)	8	sample	130	1,040	EC Environmental
	WWTP monitoring (1 location continuous)	365	day	30	10,950	EC Environmental
	Groundwater monitoring (4 locations quarterly)	16	sample	150	2,400	EC Environmental
	Noise monitoring (biannually)	2	event	2,000	4,000	EC Environmental
	Soil monitoring (10 samples single event)	10	sample	130	1,300	EC Environmental
	Waste monitoring (10 samples)	10	sample	200	2,000	EC Environmental
Site security	**Security personnel**	12	month	15,000	180,000	Staysafe Security
Validation audit	**Consultant costs**	10	day	600	6,000	EC Environmental

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Management and utility costs	**Management** (Site supervisor)	1	person year	50,000	50,000	Current salary rates
	General administration (2 days per month)	24	day	300	7,200	Current salary rates
	Insurance	1	unit	100,000	100,000	Insurance Cover Ltd
	Power	156,250	kWh	0.16	25,000	Nation Electric
	Water	100,000	m^3	2.00	200,000	Local Authority
	Fuel	300,000	litre	1.00	300,000	Fuel Supply Ltd
Total (€)					**2,106,180**	
Contingency at 20% (€)					**421,236**	
Total including contingency (€)					**2,527,416**	

8.0 Restoration/Aftercare Management Plan

Due to the historical landfill on site, a restoration/aftercare plan is necessary. In accordance with EPA guidance, the restoration/aftercare plan is relevant in two main circumstances. These are:

(a) Soil and groundwater contamination; and

(b) Landform changes, e.g. landfills, extractive waste facilities, mines, quarries and soil recovery facilities.

To date, no contamination of groundwater or soil has been detected. Therefore only item (b), landform changes, is relevant to this site.

Landform Changes

A small landfill was operated from 1995 to 2001. The landfill was used for inert C&D waste from construction activities on site. Only intermediate capping is in place (30 cm of soil).

Ground investigations and soil and groundwater testing programmes have been undertaken at the site over a number of years. These investigations also looked at the historical landfill area and no leachate plume was detected.

The capping of the landfill and installation of the drainage network are dealt with in the closure plan above. This section deals with the restoration/aftercare. The achievement of restoration targets will be assessed through a programme of medium-term monitoring. This monitoring will take place at the existing monitoring wells and the period of monitoring required will be reviewed on an annual basis, but conservatively will be in place for 5 years. It is not envisaged that additional well installation will be required.

Landfill End-Uses

It is intended to make the capped and restored landfill area into an amenity area. The landfill will be shaped to fit the natural landscape and planted with local species of plants and flowers.

Landfill Restoration

The landfill will be restored in accordance with the EPA Landfill Manuals: *Restoration and Aftercare and Landfill Site Design*. A programme for the works involved in the restoration/aftercare period has been included in Attachment __.

Landfill Aftercare

The landfill will continue to be monitored and the drainage network will be maintained for the duration of the aftercare period.

The costs of restoration/aftercare management proposals are outlined in Table A4. The landfill is inert, has an intermediate cap and has been monitored for many years and shown no environmental impact. The restoration/aftercare requirements and costs for the landfill are well defined, relatively straightforward and not subject to a large number of unknowns. In that context, a contingency of 20% is considered appropriate and is provided to allow for unplanned or unforeseeable items.

Update & Review

In accordance with the IPPC licence, *'the plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement'*. The operator commits to reviewing the restoration/aftercare plan on an annual basis and updating to reflect any significant alterations on site.

Table A4: Restoration and aftercare costing for the historical landfill

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost (€)	Source of Information
Landfill restoration	**Seeding/planting** (contractor)	5	day	500	2,500	Landfill Engineering Ltd
	Landscaping (contractor)	10	day	500	5,000	Landfill Engineering Ltd
Total restoration including contingency at 20%					**9,000**	
Landfill aftercare year 1	**Drainage maintenance**	800	m	0.5	400	Landfill Engineering Ltd
	Surface water monitoring (3 locations quarterly)	12	sample	130	1,560	EC Environmental
	Groundwater monitoring (3 locations quarterly)	12	sample	150	1,800	EC Environmental
	Fence patrol (once per month)	12	month	100	1,200	Staysafe Security
	Overheads	1	unit	5,000	5,000	Current rates
Total year 1 including contingency at 20%					**11,952**	
Landfill aftercare year 2	**Drainage maintenance**	800	m	0.5	400	Landfill Engineering Ltd
	Surface water monitoring (3 locations quarterly)	12	sample	130	1,560	EC Environmental
	Groundwater monitoring (3 locations quarterly)	12	sample	150	1,800	EC Environmental
	Fence patrol (once per month)	12	month	100	1,200	Staysafe Security
	Overheads	1	unit	5,000	5,000	Current rates
Total year 2 including contingency at 20%					**11,952**	
Landfill aftercare year 3	**Drainage maintenance**	800	m	0.5	400	Landfill Engineering Ltd
	Surface water monitoring (3 locations biannually)	6	sample	130	780	EC Environmental
	Groundwater monitoring (3 locations biannually)	6	sample	150	900	EC Environmental
	Fence patrol (once per month)	12	month	100	1,200	Staysafe Security
	Overheads	1	unit	5,000	5,000	Current rates
Total year 3 including contingency at 20%					**9,936**	

Task	Description	Quantity	Measurement Unit	Unit Rate	Cost (€)	Source of Information
Landfill aftercare year 4	**Drainage maintenance**	800	m	0.5	400	Landfill Engineering Ltd
	Surface water monitoring (3 locations biannually)	6	sample	130	780	EC Environmental
	Groundwater monitoring (3 locations biannually)	6	sample	150	900	EC Environmental
	Fence patrol (once per month)	12	month	100	1,200	Staysafe Security
	Overheads	1	unit	5,000	5,000	Current rates
Total year 4 including contingency at 20%					**9,936**	
Landfill aftercare year 5	**Drainage maintenance**	800	m	0.5	400	Landfill Engineering Ltd
	Surface water monitoring (3 locations annually)	3	sample	130	390	EC Environmental
	Groundwater monitoring (3 locations annually)	3	sample	150	450	EC Environmental
	Fence patrol (once per month)	12	month	100	1,200	Staysafe Security
	Overheads	1	unit	5,000	5,000	Current rates
Total year 5 including contingency at 20%					**8,928**	

9.0 Future-Proofing Costs

It is estimated that in the event of closure, closure and restoration costs may not be incurred for up to three years thereafter. Landfill aftercare would follow for another five years (see Table A5). Accordingly, the costs for closure and restoration/aftercare (including contingency) from Tables A3 and A4 above have been adjusted to provide for inflation as shown in Table A5.

Table A5: Cost adjustment for inflation (rate 2.5%)

				Aftercare Cost (€€				
Year	Task	Closure Cost (€)	Restoration Cost (€)	Year 1	Year 2	Year 3	Year 4	Year 5
2013	Financial provision established	2,527,416	9,000	11,952	11,952	9,936	9,936	8,928
2014	Cessation of activity	2,590,601	9,225	12,251	12,251	10,184	10,184	9,151
2015	No activity	2,655,366	9,456	12,557	12,557	10,439	10,439	9,380
2016	Closure and Restoration implemented	**2,721,750**	**9,692**	12,871	12,871	10,700	10,700	9,614
2017	Aftercare Year 1			**13,193**	13,193	10,967	10,967	9,855
2018	Aftercare Year 2				**13,523**	11,242	11,242	10,101
2019	Aftercare Year 3					**11,523**	11,523	10,354
2020	Aftercare Year 4						**11,811**	10,613
2021	Aftercare Year 5							**10,878**
Total cost adjusted for Inflation		€2,792,370						

10.0 Financial Provision

ABC Pharmachem has made the necessary financial provision to cover the closure and restoration/aftercare requirements **(€2,792,370)** by means of a bond submitted under separate cover to the EPA.

Appendix B

Example environmental liability risk assessment

Note: This example is provided for guidance to indicate the key points of the process and report. It does not reflect the full complexity of an ELRA for such an activity in reality.

Summary

Activity Details

- Name: Dairy Foods Ltd
- Address: Baile Beag, Ireland
- Licence/Permit Number: P0XXX-03
- Activities licensed:
  Class 7.2.1 'The treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on a yearly basis)'.

- RBME Category: B3 Year: 2012

Report Preparation

The report was prepared on behalf of the operator by XYZ Environmental Consultants.

- Address: XYZ Environmental Consultants
  Baile Mór, An Cathair, Ireland

Comparison with Previous ELRAs

Two previous ELRAs were submitted for 2007 and 2010 as summarised below:

Year	Plausible Worst Case Scenario Cost	Financial Provision	Expiry Date of Financial Provision
2013	€1,495,928	Bond	2016 (proposed)
2010	€1,600,000	Bond	2013
2007	€1,350,000	Bond	2010

Note: All figures include contingency.

Overview of the Plan

The operator has prepared an ELRA in accordance with Condition 12 of the IPPC Licence. The methodology for the development of the report follows EPA guidance and it has been prepared by an independent and appropriately qualified consultant.

Financial Provision

The financial provision is based on the plausible worst case scenario. This is the maximum liability that may be incurred and is calculated at **€1,495,928**.

Dairy Food Ltd has made the necessary financial provision to cover this liability by means of bond submitted under separate cover to the EPA.

1.0 Introduction

The activity licensed is as follows:

> *Class 7.2.1 'The treatment and processing of milk, the quantity of milk received being greater than 200 tonnes per day (average value on a yearly basis)'.*

The IPPC licence was granted in 1996. Condition 12 of the IPPC licence states:

> *The licensee shall arrange for the completion, by an independent and appropriately qualified consultant, of a comprehensive and fully costed Environmental Liabilities Risk Assessment (ELRA) which addresses the liabilities from past and present activities. The assessment shall include those liabilities and costs identified in Condition 10 for execution of the DMP. A report on this assessment shall be submitted to the Agency for agreement within twelve months of date of grant of this licence. The ELRA shall be reviewed as necessary to reflect any significant change on site, and in any case every three years following initial agreement. Review results are to be notified as part of the AER.*

This report has been prepared to satisfy this condition of the IPPC licence. The methodology for the development of the ELRA follows EPA guidance and it has been prepared by an independent and appropriately qualified consultant.

The ELRA has been prepared to accurately reflect the risks of unplanned but plausible incidents occurring.

2.0 Scoping

The licence condition for the activity states that the ELRA should address the liabilities from past and present activities. In this regard, all aspects of the historic operation and current site operation that pose a plausible risk to the environment are covered in this ELRA.

Planned liabilities associated with closure are not considered in this ELRA and have been addressed in the Closure Plan prepared in accordance with Condition 10 of the licence.

3.0 Risk Identification

The following section outlines the site characteristics which allow the plausible environmental risks for the activity to be identified.

Site Operation

The activity was constructed on a greenfield site in 1996 and has been engaged in the current operation since this time. There have been no significant changes to the manufacturing processes on site since the licence was granted.

The following infrastructure is present on the site:

- **Raw milk silos**
- **Milk pasteurisers**
- **Pasteurised milk silos**
- **Evaporators**
- **Driers**
- **Clean in place (CIP) chemical store**

- **Waste water treatment plant** – balancing, pH correction, sedimentation, biofiltration, clarification and sludge treatment and storage. The final treated effluent is discharged to the River Abhann at SW1.
- **Storm drain network** services the hard standing areas remote from the production building and chemical stores including the car parks. The storm network is gravity fed to a silt trap and interceptor prior to discharge to the River Abhann at SW2.
- **Fuel storage** – one fuel tank (50 m^3 capacity).
- **Utilities** – two boilers.
- **Refrigeration units**
- **Potable water supply tank**
- **Administration building containing laboratory and canteen**

Operator Performance

The activity has been in operation since 1996 and has been licensed by the Agency since 1996. The operator maintains an EMS with full ISO 140001 accreditation, in compliance with Condition 2.2 Environmental Management System (EMS) of the IPPC Licence (PXXXX-01), maintaining a schedule of Environmental Objectives and Targets, which is reviewed on an annual basis.

There were no environmental complaints in relation to the activity for the reporting period of 2012. One complaint was received in 2010, in relation to odour.

There were two significant environmental incidents reported since the licence was issued:

- One incident was in relation to a spillage of milk during a delivery. This resulted in a discharge to the River Abhann and a fish kill. Additional containment measures have since been installed in the loading area.
- The second incident was a spillage in the fuel storage area resulting in contaminated land. This was investigated and remediated. Contaminated soils were excavated and removed for disposal off site.

Both incidents were reported to the Agency in full at the time of the event to ensure the appropriate actions were undertaken.

Apart from the above, the main compliance issue has been failure to maintain consistent compliance with air emission limit values.

Environmental Sensitivity

The environmental sensitivity is considered with respect to the following:

Geology/Hydrogeology: The bedrock geology underlying the site is Dinantian Limestone and is classified as a Regionally Important Aquifer (Rkd) – Karstified (conduit). The groundwater vulnerability is classified as High (H). Previous site investigations for the EIS to support the planning application indicate that the geology beneath the site comprises drift deposits of till and alluvium overlying limestone bedrock. The Tills comprise gravelly clays and are up to 12 m thick over the higher ground in the west and north of the site. Silty alluvial clays and sands overlie the bedrock in the south and east of the site and are approximately 5 m thick. Groundwater flow direction is towards the River Abhann adjacent to the site.

Surface Water Bodies: The River Abhann is adjacent to the eastern boundary of the site. Discharge from the WWTP (SW1) and surface water run-off (SW2) are discharged to the River Abhann. The river discharges into Estuary Mór. This is classified by the EPA as having 'unpolluted' transitional and coastal water status. Process waste waters are directed to the on-site waste water treatment plant. The effluent is treated by a mixture of physical and biological treatment before it is discharged to the river.

Natural Habitats: The estuary is a proposed National Heritage Area (pNHA), a Special Protection Area (SPA) and a Special Area of Conservation (SAC). All are located within 1 km of the site.

Human Receptors: The site is located north of the village Baile Beag, which is the nearest built-up area. The nearest residential receptors are located along the western boundary of the site, with the nearest properties located 100 m from the site. The site is surrounded by agricultural land.

During the risk identification, all the processes on site were identified and the risks associated with each process were listed. The risk identification process was achieved by means of a risk workshop facilitated by the independent consultant and including the site environmental, production and facilities managers. All potential causes of failure of the processes and the effect/impact on the environment were identified. All plausible risks identified are listed in Table B1.

Table B1: Plausible risks identified for the activity

Risk ID	Process	Potential Risk
1	Fuel Storage	Fuel spillage during tanker unloading/delivery operations
2		Loss from above-ground tanks/pipelines, groundwater and/or soil contamination
3	Milk Storage and Handling	Spillage during tanker unloading/delivery operations
4		Loss from bulk storage tanks/pipelines, discharge to surface water
5	Chemical Storage and Handling	Loss from IBC/drums during storage or handling
6	Production	Spillages from production
7	Weather	Flooding on the site causing uncontrolled discharge
8	Sludge Management	Leaching from sludge storage, impact on surface water, groundwater and/or soils
9		Exceedance of sludge storage capacity, impact on surface water, groundwater and/or soils
10	Air Abatement Systems	Failure of abatement, release of unabated emissions to atmosphere
11	Drainage Network	Excessive loss of suspended solids to surface water network
12	Waste Water Treatment Systems	Losses and overflows from above-ground tanks and pipelines
13		Unscheduled or shock load discharge from production disrupting treatment process
14		Non-compliant discharge from treatment plant to surface water
15	Fire in Production Area	Emissions to air, fire water discharge to surface water or groundwater
16	Traffic	Loss to environment due to incidents involving vehicles (forklifts, trucks, etc.)

4.0 Risk Analysis

The risks above were assessed against likelihood and consequence as per Tables B2 and B3; the results are presented in Table B4.

Table B2: Risk classification table – likelihood

Rating	Likelihood	
	Category	Description
1	Very Low	Very low chance of hazard occurring
2	Low	Low chance of hazard occurring
3	Medium	Medium chance of hazard occurring
4	High	High chance of hazard occurring
5	Very High	Very high chance of hazard occurring

Table B3: Risk classification table – consequence

Rating	Consequence	
	Category	Description
1	Trivial	No impact or negligible change to the environment.
2	Minor	Minor impact/localised or nuisance
3	Moderate	Moderate impact to environment
4	Major	Severe impact to environment
5	Massive	Massive impact to a large area, irreversible in medium term

Table B4: Risk analysis

Risk ID	Process	Potential Risks	Environmental effect	Consequence Rating	Basis of Consequence	Likelihood Rating	Basis of Likelihood	Risk Score (Consequence × Likelihood)
1	Fuel Storage	Fuel spillage during tanker unloading/ delivery operations	Contamination of surface water, soil and groundwater	3	Tanker volume is limited. Hazardous and persistent material.	3	Delivery is in contained area. SOP and supervision of delivery.	9
2	Fuel Storage	Loss from above-ground tanks/pipelines, groundwater and/or soil contamination	Contamination of soil and groundwater	4	Large volume loss. Hazardous and persistent material. Shallow overburden and underlying aquifer is classified as highly vulnerable limestone.	3	Tank is in a bunded location. Tanks, bunds and pipelines infrequently inspected and tested. Previous incident occurred.	12
3	Milk Storage and Handling	Spillage during tanker unloading/ delivery operations	Contamination of surface water, soil and groundwater	3	Tanker volume may be high. Potential for fish kill. Non-hazardous and not persistent.	4	Delivery is in contained area. Delivery is a high-frequency event. SOP and supervision of delivery. Previous incident occurred.	12
4	Milk Storage and Handling	Loss from bulk storage tanks/ pipelines – discharge to surface water	Contamination of surface water	4	Large volume loss. Potential for fish kill. Non-hazardous and not persistent.	4	Tanks are in bunded locations. Tanks, bunds and pipelines infrequently inspected and tested. Level alarms installed. High number of tanks subject to ongoing use.	16
5	Chemical Storage and Handling	Loss from IBC/ drums during storage or handling	Contamination of surface water, soil and groundwater	1	Very low volumes. Hazardous but not persistent.	3	Forklift driver trained. Storage in bunded areas. High-frequency movements.	3

Risk ID	Process	Potential Risks	Environmental effect	Consequence Rating	Basis of Consequence	Likelihood Rating	Basis of Likelihood	Risk Score (Consequence × Likelihood)
6	Production	Spillages from production	Contamination of surface water, soil and groundwater	2	Losses would be low volume. Non-hazardous and not persistent.	2	Production area contained and all run-off diverted to WWTP.	4
7	Weather	Flooding on the site causing uncontrolled discharge	Contamination of surface water, soil and groundwater.	4	Large volume loss. Potential for fish kill.	1	Site is located in a very low flood risk area.	4
8	Sludge Management	Leaching from sludge storage, impact on surface water, groundwater and/or soils	Contamination of surface water, soil and groundwater	2	Losses would be low volume. Non-hazardous and not persistent.	2	Stored in a covered area. Integrity tested and inspected regularly. Drainage directed to WWTP.	4
9	Sludge Management	Exceedance of sludge storage capacity, impact on surface water, groundwater and/or soils	Contamination of surface water, soil and groundwater	3	Higher volume losses. Non-hazardous and not persistent.	2	Storage capacity caters typically for 1 year sludge production + 20%.	6
10	Air Abatement Systems	Failure of abatement, release of unabated emissions to atmosphere	Air pollution	2	Elevated stack providing good dispersion.	5	Failure to maintain consistent compliance with air emission limit values.	10
11	Drainage Network	Excessive loss of suspended solids to surface water network	Contamination of surface water	1	Non-hazardous and not persistent. Low volume.	3	Interceptors, silt traps and continuous monitors on emission points.	3
12	Waste Water Treatment Systems	Losses and overflows from above-ground tanks and pipelines	Contamination of surface water	3	Large volume loss. Potential for fish kill. Non-hazardous and not persistent	3	Tanks and pipelines regularly inspected and tested. Level alarms installed.	9

Risk ID	Process	Potential Risks	Environmental effect	Consequence Rating	Basis of Consequence	Likelihood Rating	Basis of Likelihood	Risk Score (Consequence × Likelihood)
13	Waste Water Treatment Systems	Unscheduled or shock load discharge from production disrupting treatment process	Contamination of surface water	3	Potential for fish kill. Non-hazardous and not persistent	2	SOP in production area in relation to preventing shock loads. Monitoring and alarms on WWTP inlet. Spare balancing capacity available.	6
14	Waste Water Treatment Systems	Non-compliant discharge from treatment plant to surface water	Contamination of surface water	3	Potential for fish kill. Non-hazardous and not persistent	3	Good compliance history. Good balancing capacity. Standby pumps etc. Continuous monitoring and alarms at outlet. Highly trained staff.	9
15	Fire in production area	Emissions to air, fire water discharge to surface water or groundwater	Contamination of surface water, soil and groundwater. Air emissions	4	Potential large volume loss. Mixed pollutant content. Fish kills and groundwater contamination.	3	Low volume of combustible materials on site. Extensive fire protection measures. Emergency response team in place. No fire water retention capacity.	12
16	Traffic	Loss to environment due to incidents involving vehicles (forklifts, trucks, etc.)	Contamination of surface water, soil and groundwater	3	Tanker volumes may be high. Potential for fish kill and contamination of groundwater.	4	High traffic frequency. Good signage in place.	12

5.0 Risk Evaluation

The risks are ranked in **Table B5** to assist in prioritisation for risk treatment process.

Table B5: Risk evaluation table

Risk ID	Process	Potential Risks	Consequence Rating	Likelihood Rating	Risk Score
4	Milk Storage and Handling	Loss from bulk storage tanks/pipelines – discharge to surface water	4	4	16
2	Fuel Storage	Loss from above-ground tanks/pipelines, groundwater and/or soil contamination	4	3	12
3	Milk Storage and Handling	Spillage during tanker unloading/delivery operations	3	4	12
15	Fire in Production Area	Emissions to air, fire water discharge to surface water or groundwater	4	3	12
16	Traffic	Loss to environment due to incidents involving vehicles (forklifts, trucks, etc.)	3	4	12
10	Air Abatement Systems	Failure of abatement, release of unabated emissions to atmosphere	2	5	10
1	Fuel Storage	Fuel spillage during tanker unloading/delivery operations	3	3	9
12	Waste Water Treatment Systems	Losses and overflows from above-ground tanks and pipelines	3	3	9
14	Waste Water Treatment Systems	Non-compliant discharge from treatment plant to surface water	3	3	9
9	Sludge Management	Exceedance of sludge storage capacity, impact on surface water, groundwater and/or soils	3	2	6
13	Waste Water Treatment Systems	Unscheduled or shock load discharge from production disrupting treatment process	3	2	6
6	Production	Spillages from production	2	2	4
7	Weather	Flooding on the site causing uncontrolled discharge	4	1	4
8	Sludge Management	Leaching from sludge storage, impact on surface water, groundwater and/or soils	2	2	4
5	Chemical Storage and Handling	Loss from IBC/drums during storage or handling	1	3	3
11	Drainage Network	Excessive loss of suspended solids to surface water network	1	3	3

The risk matrix is displayed in **Table B6**. The risks have been colour coded in the matrix to provide a broad indication of the critical nature of each risk in order to facilitate prioritisation of risks for treatment.

The risk matrix indicates that there is one risk in the red zone (Risk ID 4) requiring priority treatment. There are eight risks in the amber zone requiring treatment through mitigation or management action. All other risks are located in the green zone, indicating the need for continuing awareness and monitoring on a regular basis. However, assessment of the green zone risks has indicated that a number of these risks can be reduced through the implementation of mitigation measures. These risk treatment measures will be adopted where considered cost-effective to further reduce the risks.

Table B6: Risk matrix

Likelihood						
V. High	**5**		**10**			
High	**4**			**3, 16**	**4**	
Medium	**3**	**5, 11**		**1, 12, 14**	**2, 15**	
Low	**2**		**6, 8**	**9, 13**		
V. Low	**1**				**7**	
		Trivial	**Minor**	**Moderate**	**Major**	**Massive**
		1	**2**	**3**	**4**	**5**
				Consequence		

6.0 Risk Treatment

The output of the risk treatment process is the development of a statement of measures to be taken to minimise the environmental risk of the activity. The statement of measures is presented in **Table B7**, where a set of appropriate and achievable mitigation measures are assigned to each risk, with a risk owner responsibility for the ongoing management of the risk and a timeframe for implementation of the risk mitigation measure.

Table B7: Statement of measures

Risk ID	Potential Risk	Risk Score	Mitigation Measures to be taken	Outcome	Action	Date for Completion	Owner/ Contact Person
4	Loss from bulk storage tanks/ pipelines –discharge to surface water	16	Increase tank and bund integrity assessment to annual frequency.	Increased tracking of potential faults in tank/bund structure	Contract structural engineer to carry out works.	Immediate	Facilities Manager
2	Loss from above-ground tanks/pipelines, groundwater and/or soil contamination	12	Increase tank and bund integrity assessment to annual frequency. Install level alarms in tanks.	Increased tracking of potential faults in tank/bund structure	Contract structural engineer to carry out works.	Immediate	Facilities Manager
3	Spillage during tanker unloading/ delivery operations	12	Install remote bund around tanker loading/unloading area sized for one full tanker and 25% contingency.	Full containment of tanker spill locally reducing potential environmental impact	Commission engineer to design bund and action contractor to spec project.	3 months	Production Manager
15	Emissions to air, fire water discharge to surface water or groundwater	12	Review fire water risk assessment. Calculate the retention volumes required for such an event. Carry out cost–benefit analysis installation of retention pond.	Increased fire water containment capacity on site if option is progressed	Commission engineer to review fire water risk assessment including cost–benefit analysis.	3 months	Environmental Manager
16	Loss to environment due to incidents involving vehicles (forklifts, trucks, etc.)	12	Reduce speed limit on site to 15 km/h on all site roads and car parking areas. Include traffic hazard awareness in environmental training.	Improved awareness and reduced potential for traffic hazards	Update training manual. Revise signage across site for speed limit.	3 months	Environmental Manager
10	Failure of abatement, release of unabated emissions to atmosphere	10	Investigate alternative abatement options for the relevant stacks. Possible use of back-up system such as secondary bag filter.	Reduced potential for breaches of ELV	Contact abatement supplier and initiate discussions on alternative/ supplementary abatement options.	6 months	Environmental Manager

Risk ID	Potential Risk	Risk Score	Mitigation Measures to be taken	Outcome	Action	Date for Completion	Owner/ Contact Person
1	Fuel spillage during tanker unloading/ delivery operations	9	Install level alarms on all fuel tanks.	Reduced potential for spillage during unloading operations	Purchase and install level alarms for all fuel tanks.	6 months	Facilities Manager
12	Losses and overflows from above-ground tanks and pipelines	9	Increase tank and pipeline integrity assessment to biannual frequency. Install level alarms on the main tanks.	Increased tracking of potential faults in tank/pipeline	Contract structural engineer to carry out works.	6 months	Facilities Manager
14	Non-compliant discharge from treatment plant to surface water	9	Install automatic shut-off valve on discharge point. Trigger values to be set on continuous monitor to initiate valve.	Reduced potential for ELV breach	Purchase and install automatic shut-off valve on discharge point.	6 months	Facilities Manager
9	Exceedance of sludge storage capacity, impact on surface water, groundwater and/or soils	6	Carry out full review of sludge storage capacity and projected volumes. Calculate worst case capacity requirements and revise storage capacity as required.	Reduced potential for storage exceedance	Commission engineer to review existing storage against projected volumes and advise of options as required.	9 months	Facilities Manager
13	Unscheduled or shock load discharge from production disrupting treatment process	6	Investigate potential for increase in existing balancing capacity at inlet.	Increased attenuation volume for high-conc. or high-volume shock loads	Commission engineer to review existing balancing capacity against worst case projected volumes and advise of options as required.	9 months	Facilities Manager
6	Spillages from production	4	Increased sill awareness and management training to be provided to all staff.	Reduced frequency and impact of spills	Revise training manual and commence revised training programme.	3 months	Environmental Manager
7	Flooding on the site causing uncontrolled discharge	4	Check OPW data on potential flood risk of the site. Revise emergency response procedures as required.	Increased awareness of response procedures and reduced impact	Carry out flood risk assessment and revise emergency procedures accordingly.	3 months	Environmental Manager

Risk ID	Potential Risk	Risk Score	Mitigation Measures to be taken	Outcome	Action	Date for Completion	Owner/ Contact Person
8	Leaching from sludge storage, impact on surface water, groundwater and/or soils	4	Existing controls are adequate. Regular inspections should be undertaken to assess potential for discharge.	Increased awareness of likelihood of event	Commence weekly inspections to determine frequency and nature of spills.	3 months	Environmental Manager
5	Loss from IBC/ drums during storage or handling	3	Revise driver training and awareness programmes.	Reduced frequency and impact of spills	Revise training manual and commence revised training programme.	3 months	Environmental Manager
11	Excessive loss of suspended solids to surface water network	3	Regular inspections should be undertaken to assess potential for discharge.	Increased awareness of likelihood of event	Commence weekly inspections to determine frequency and nature of spills. Site cleaning modified as required.	3 months	Environmental Manager

7.0 Identification of Plausible Worst Case Scenario

The ELRA for this activity identified a number of risks with a major consequence; therefore, further analysis was conducted to determine the plausible worst case scenario. It was determined that fire in the production area (**Risk ID 15**) could trigger **Risk ID 2** (loss from above-ground fuel tanks/ pipelines, groundwater and/or soil contamination) and **Risk ID 5** (loss from IBC/drums during storage or handling). This is considered plausible as both the fuel storage area and chemical store are located directly adjacent to the production area and would be impacted by a fire in production. These combined risks are considered the plausible worst case scenario for the activity and are quantified and costed for the purposes of financial provision below.

8.0 Quantification and Costing

The plausible worst case scenario (combined event of Risk IDs 2, 5 and 15) has been quantified and costed in Table B8. The grouping of Risk ID 2 and 5 is to facilitate the costing as the response measures necessary are similar.

The plausible worst case scenario is predicted to involve:

- Generation of 400 tonnes of fire water which would be contained.
- Loss of 50 tonnes of fire water to ground resulting in contamination of 300 tonnes of soil (non-hazardous).
- Loss of 25 m^3 of oil from storage tank (assume 50% loss due to bund overtopping) and 10 m^3 from IBC storage to ground resulting in contamination of 600 tonnes of soil (hazardous) and 2,400 tonnes of soil (non-hazardous).
- Generation of 200 tonnes of waste from decontamination of buildings.
- In addition to containment, excavation, transport and disposal of those losses, additional control and remediation measures include:
    - Fire fighting
    - Site investigation.
    - Temporary replacement water supply
    - Groundwater pump and treat
    - Monitoring
    - Landscaping
    - Consultancy

Table B8: Quantification and costing of plausible worst case scenario

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Response to: **Risk ID 15**: Fire in production area	Fire fighting	2	day	20,000	40,000	Fire Service
	Excavation and construction of temporary fire water containment	1	unit	10,000	10,000	AB Contractor
	Transport of fire water	400	tonne	50	20,000	Haulier Ltd
	Disposal gate fee for fire water	400	tonne	25	10,000	WWTP Ltd
	Excavation of contaminated soil (non-hazardous)	200	m3	10	2,000	AB Contractor
	Transport of contaminated soil (non-hazardous)	300	tonne	30	9,000	Haulier Ltd
	Disposal gate fee for contaminated soil (non-hazardous)	300	tonne	50	15,000	Waste Co.
	Consultancy costs	20	day	600	12,000	EC Environmental
	Importation of topsoil	80	tonne	11	880	Landscaping Ltd
	Landscaping	2	day	500	1,000	Landscaping Ltd
	Decontamination of the building	30	day	1,750	52,500	ABC Cleaners
	Transport of decontamination wastes	200	tonne	30	6,000	Haulier Ltd
	Disposal gate fee of decontamination waste	200	tonne	50	10,000	Waste Co.
	Surface water monitoring	40	sample	130	5,200	EC Environmental
	Groundwater monitoring	200	sample	150	30,000	EC Environmental
	Air monitoring	20	sample	200	4,000	EC Environmental
	Ecological monitoring	12	sample	1,000	12,000	EC Environmental
	Waste monitoring	40	sample	200	8,000	EC Environmental

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of Unit Rates
Response to: **Risk ID 2:** loss from above-ground fuel tanks/pipelines, groundwater and/or soil contamination **Risk ID 5:** loss from IBC/drums during storage or handling	Trial pits	20	pit	100	2,000	Groundtec Ltd
	Boreholes	10	well	1,700	17,000	Groundtec Ltd
	Soil monitoring	30	sample	130	3,900	EC Environmental
	Excavation of contaminated soil (hazardous)	400	m3	10	4,000	AB Contractor
	Excavation of contaminated soil (non-hazardous)	1,600	m3	10	16,000	AB Contractor
	Installation of lined holding area	1	unit	26,000	26,000	AB Contractor
	Transport of contaminated soil (hazardous)	600	tonne	70	42,000	Haulier Ltd
	Transport of contaminated soil (non-hazardous)	2,400	tonne	30	72,000	Haulier Ltd
	Disposal gate fee for contaminated soil (hazardous)	600	tonne	150	90,000	Waste Co.
	Disposal gate fee for contaminated soil (non-hazardous)	2,400	tonne	50	120,000	Waste Co.
	Installation and operation of pump and treat	1	year	200,000	200,000	Groundtec Ltd
	Consultancy costs	40	day	600	24,000	EC Environmental
	Temporary replacement water supply	1	unit	200,000	200,000	Water Supply Co.
	Importation of topsoil	140	tonne	11	1,540	Landscaping Ltd
	Landscaping	5	day	500	2,500	Landscaping Ltd
Total (€)					**1,068,520**	
Contingency at 40% (€)					**427,408**	
Total including contingency (€)					**1,495,928**	

9.0 Conclusion

An environmental liabilities risk assessment has been carried out for the activity in accordance with EPA guidance.

The financial provision has been based on the combined risks that pose the plausible worst case scenario. This is the maximum liability that may be incurred and as such, financial provision is calculated as **€1,495,928** based on this event.

Dairy Food Ltd has made the necessary financial provision to cover this liability by means of a bond submitted under separate cover to the EPA.

The risk management at the activity is a dynamic process and will be updated through the addition of new risks or the omission of redundant risks. The financial provision will be reviewed in accordance with the requirements of Condition 12 to ensure that it continues to cover the environmental liabilities.

Appendix C

Costs associated with incidents

Table C1 sets out information available to the EPA on environmental costs in relation to previous incidents/accidents in Ireland. It refers to environmental costs only, i.e. costs relating to prevention and control of emissions and remediation of pollution. It does not include costs associated with employee or third party personal injury claims, damage to private property, economic loss or legal costs/fines. It should also be noted that some of the operations are not subject to waste/IPPC/IED licensing and are lower risk than the type of facilities the EPA regulates under those regimes.

Table C1: Incidents/accidents in Ireland

Facility	Description of incident/accident	Costs cover	Cost
Landfill (licensced)	Fire	Fire fighting; waste management; leachate management; consulting; security; monitoring	€2,790,000
Waste transfer station (licenced)	Fire	Fire fighting; fire water; consulting; monitoring; demolition; waste management; staff and management	€410,000
Waste recycling facility (permitted)	Leaks/spillages of hydrocarbons to drains and ground	New/repaired pollution control infrastructure; clean-up of drains and ground; monitoring; consultancy; waste water; staff	€1,280,000
Feed mill	Oil leak (approximately 2000 litres) from pipe impacting on surface water and downstream drinking water treatment plant	Clean-up of watercourses; monitoring of surface and drinking water; alternative drinking water supply; clean-up and management of treatment plant; helpline	€870,000
Grain store	Spill of insecticide to surface water	Estimated cost of 1/1 fish restocking	€35,000

The International Underwriting Association of London and Berwin Leighton Paisner LLP published *Environmental loss scenarios - A report from the IUA's non-marine environmental committee in 2013*. This report also provides site-specific environmental costs associated with incidents/accidents, again mainly associated with relatively low risk activities (Table C2).

Table C2: Incidents/accidents in the UK

Facility	Description of incident/accident	Costs cover	Cost*
Composting	Fire including loss of fire water to surface waters; fish kill	Clean-up	€120,000
Light industrial	Solvent spill to ground	Clean-up	€480,000
Hotel	Heating oil leak (10,000 litres) to ground	Clean-up	€540,000
Village hall	Heating oil leak (several thousand litres) to ground	Investigation and clean-up	€600,000
Tanker	Spill of pesticide to dry ditch during transport along public road	Clean-up	€20,000

*Converted from sterling to euro on basis of £1.00 stg = €1.20.

There are also various reports of costs associated with other incidents in the EU, in particular for major incidents. These are shown in Table C3, limited as far as possible to costs associated with prevention and control of emissions and remediation of pollution. This information is not as clear as above, may be estimated rather than incurred and may not include the full environmental costs. Nonetheless, it serves to indicate the level of liabilities that can be incurred in relation to major incidents, which are in the tens to hundreds of millions of euro. These incidents also have significant additional costs associated with personal injury claims, damage to private property, economic loss and legal costs/fines.

Table C3: Other EU incidents/accidents

Incident/accident*	Comments	Costs
Buncefield, UK	Oil-products storage depot Seveso site Vapour cloud explosion and fire Major losses of fuel, foam and fire water to environment Costs do not include those associated with storage and treatment of fire water	Competent authority and government response €18m** Emergency response €8.4m** Environmental impact (drinking water) €2.4m**
Chemie-Pack, Netherlands	Storage, blending, filling and packaging of chemicals 50 employees Seveso site Fire	Estimated costs: Land damage €38.2m Waterbed pollution of ditches €13.5m Cleaning up above the ground €9.6m Management of fire water €2.5m Waterbed pollution port €1.6m
Boliden Apirsa mine, Aznalcóllar, Spain	Large-scale losses from mine tailings dam	Remedial and restoration measures cost local and national authorities around €101m. Protective measures cost the authorities a further €70m.
AZF chemical plant, France	Explosion resulting in the release of nitric acid and ammonia into river, leading to large-scale destruction of aquatic fauna	The clean-up pollution operation and the rehabilitation of the site cost an estimated €250m.

*Sources: *European Commission (2013) Study to explore the feasibility of creating a fund to cover environmental liability and losses occurring from industrial accidents*; Nicolette Bouman (Ministry of Infrastructure and the Environment, The Netherlands) (2012) *Fire at Chemie-Pack*; Mike Jenkins (Environment Agency Technical Adviser) (2013) Calculating the cost of pollution incidents.

**Converted from sterling to euro on basis of £1.00 stg = €1.20.

Abbreviations/glossary

Activity	'Activity' is used in this guidance in the general sense and may refer to an Integrated Pollution Prevention and Control, Waste, Waste Water Discharge, Dumping at Sea or, indeed, any other activity.
AER	Annual environmental report
BAT	Best available techniques
C&D	Construction and demolition
Closure	Closure refers to relatively short-term measures necessary to close a site satisfactorily, including decommissioning and residuals management. **Closure plan** should be read accordingly.
Consequence	The outcome of an incident
CRAMP	Closure, restoration and aftercare management plan
DaS	Dumping at sea
DMP	Decommissioning management plan
DREAM	Dynamic risk enforcement assessment methodology
EIA	Environmental impact assessment
EIS	Environmental impact statement
ELRA	Environmental liability risk assessment
ELV	Emission limit value
EMAS	Eco-Management and Audit Scheme
EMS	Environmental management systems
Environmental liabilities risk assessment (ELRA)	Environmental liabilities risk assessment refers to the assessment and costing of liabilities arising from incidents. Incidents include accidents.
Environmental sensitivity	The sensitivity of the receiving environment in the vicinity of an activity
EPA	Environmental Protection Agency
EWC	European Waste Catalogue

Financial provision (FP)	Financial provision refers to the putting in place of a financial instrument (such as an insurance, bond, guarantee or fund) to cover the costs of closure, restoration/aftercare or incidents. Other terms referring to essentially the same thing may be seen elsewhere, such as financial security, financial guarantee and financial mechanism.
HDPE	High-density polyethyene
HSA	Health and Safety Authority
IBC	Intermediate bulk container
IED	Industrial Emissions Directive
Incident	'Incident' generally refers to a change of circumstances from the norm with actual or potential negative consequences. The IED refers to incidents and accidents, but for the purposes of this guidance the term 'incident' only is used, and is taken to include accidents within its meaning.
IPPC	Integrated Pollution Prevention and Control
LFG	Landfill gas
Likelihood	The chance of an incident happening
MNA	Monitored natural attenuation
NHA	National Heritage Area
PCB	Polychlorinated biphenyl
Plausible worst case scenario	The plausible event that poses the maximum environmental liability, i.e. consequence.
Pollution	As defined in relevant legislation
PPE	Personal protective equipment
RBME	Risk-based methodology for enforcement
Restoration/aftercare	Restoration/aftercare refers to longer term measures that are necessary where environmental liabilities remain following closure, e.g. contaminated soil and groundwater, landfills, extractive waste facilities, mines, quarries and soil recovery facilities. Measures may encompass activities such as rehabilitation, remediation, restoration, ongoing emissions control and monitoring. **Restoration/aftercare** plan should be read accordingly.
RMP	Residuals management plan
SAC	Special Area of Conservation

Satisfactory state	As defined in relevant legislation
SOP	Standard operating procedures
SPA	Special Protection Area
Statement of measures	A list of measures taken or adopted to prevent environmental impact
VAT	Value added tax
WAC	Waste acceptance criteria
WEEE	Waste Electrical and Electronic Equipment
WWD	Waste water discharge
WWDA	Waste water discharge authorisations
WWTP	Waste water treatment plant

An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe. Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

- Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:
- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail.
- scardadh dramhuisce
- dumpáil mara

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir. Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

Office of
Environmental
Enforcement

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