INTEGRATED POLLUTION CONTROL IN ENGLAND AND WALES

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SUMMARY

This paper describes the principles of Integrated Pollution Control (IPC). Also mentioned are new procedures introduced by Her Majesty's Inspectorate of Pollution (HMIP) to carry out environmental assessments in determining IPC applications. The paper illustrates how IPC and the concepts of BATNEEC and BPEO can be applied in regulating complex industrial processes.

1 HMIP's ROLE

HMIP protects the environment by enforcing regulations to prevent pollution.
In carrying out this role HMIP will:

- authorise, enforce, inspect and monitor under the relevant legislation;
- consult openly and widely and report on its performance;
- provide expert advice to Government;
- initiate R&D and disseminate its results; and
- work cost effectively to the highest professional standards.

2 INTEGRATED POLLUTION CONTROL

The statutory basis for Integrated Pollution Control (IPC) is provided in Part 1 of the Environmental Protection Act 1990. IPC requires that no prescribed process can be operated without a prior authorisation from HMIP. The prescribed processes to be controlled under IPC and the timetable for their introduction into the new systems (see Annex 1), as well as the prescribed substances (see Annex 2), are set out in detail in the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

The Environmental Protection (Applications, Appeals and Registers) Regulations 1991 outline the procedures for applying to HMIP for authorisation, the information required by HMIP, the bodies which HMIP must consult and requirements for advertising the application and for placing relevant information on a public register.

HMIP is required either to grant an authorisation, subject to any conditions which the Act requires or empowers it to impose, or to refuse it. HMIP must refuse it unless we consider that the applicant will be able to carry on the process in compliance with the conditions in the authorisation.

In setting the conditions, Section 7 of the Act places HMIP under a duty to ensure that certain objectives are met. The conditions should ensure that:

- The best available techniques (both technology and operating practices) not entailing excessive cost (BATNEEC) are used to prevent or, if that is not practicable, to minimise the release of prescribed substances into the medium for which they are prescribed; and to render harmless both any prescribed substances which are released and any other substances which might cause harm.

- Releases do not cause, or contribute to, the breach of any direction given by the Secretary of State to implement European Community or international obligations relating to environmental protection, or any statutory environmental quality standards or objectives, or other statutory limits or requirements.
- When a process is likely to involve releases into more than one environmental medium (which will probably be the case in many processes prescribed for IPC), the best practicable environmental option (BPEO) is achieved, ie the releases from the process are controlled through the use of BATNEEC to give the least overall affect on the environment as a whole.

The concept of BATNEEC contains an inbuilt dynamic towards higher standards because as available techniques improve so will environmental protection standards be raised.

3 IPC APPLICATIONS

In applying for an IPC authorisation an operator should:

- provide full information on the selection of primary process, particularly for a new plant;
- provide evidence that the requirement to use BATNEEC will be met;
- select a combination of primary process,pollution abatement techniques and waste treatment and disposal which constitutes the BPEO; and
- provide a justification for the BPEO selected and for all likely releases.

4 CHIEF INSPECTORS' GUIDANCE NOTES

Process operators, and indeed the public, will require an assurance that BATNEEC is applied in a rational and consistent way. BATNEEC standards for each class of IPC process are set out in published guidance notes issued to Inspectors. In preparing the notes HMIP reviews available techniques internationally as well as tapping industry's own expertise and experience.

The aim of the Guidance Notes is to provide Inspectors (and Industry) with the main emission standards for prescribed substances arising from each process. They also outline the minimum standards that are expected to be attained by existing plant, and what constitutes BATNEEC for new plant and processes.

The Guidance Notes take into consideration the results of BAT research reviews that have been commissioned by the Inspectorate. A wide range of reviews of BAT have so far been carried out. Among other things, the notes give guidance on:

- the general provisions of IPC;
- the timescale for updating existing plants to new plant standards;
- definition of substantial change;
- BATNEEC/BPEO process/abatement techniques;
- release levels corresponding to those techniques; and
- compliance monitoring.

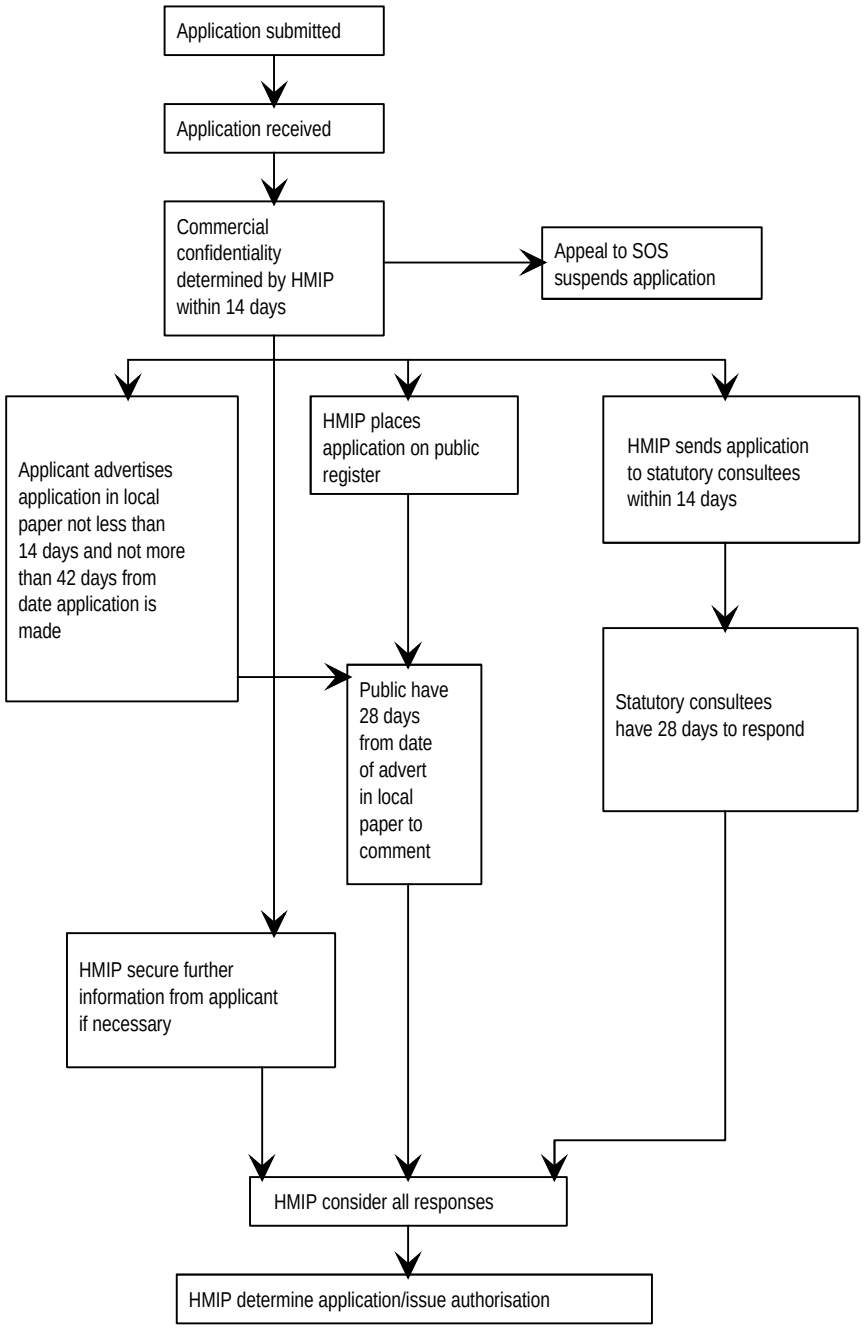

Figure 1. Applications main steps and timetable.

5 ENVIRONMENTAL ASSESSMENTS FOR IPC

HMIP is developing a framework for the assessment of environmental harm arising from release from prescribed processes designed to yield the environmental information required to establish the site specific BATNEEC. It consists of a number of elements, for example:

- the identification and quantification of releases;
- determining whether releases comply with statutory emission limits;
- a scoping exercise to identify environmentally significant releases;
- determining whether the releases comply with statutory environmental quality objectives;
- determining the environmental acceptability of the releases;
- identifying the BPEO from a number of environmentally acceptable process/ abatement options; and
- identifying the process and environmental monitoring requirements.

6 PRINCIPLES OF THE IPC ENVIRONMENTAL ASSESSMENT PROCEDURE

A prescribed process should meet the standards set out in Chief Inspectors Guidance Notes, either those actually described in the relevant note, or one which achieves an equivalent or better standard. The operator should indicate the range of process/abatement options considered in deciding on the eventual choice. If an option is proposed that clearly falls below the best practicable environmental option then the operator should justify the choice in terms of cost effectiveness, i.e. by comparing the cost and environmental implications of the preferred and any discounted options. It will be for the site inspector to assess whether or not sufficient justification has been provided, perhaps by carrying out a separate assessment.

6.1 Assessment of harm under integrated pollution control

When Integrated Pollution Control was first introduced in April 1991 only general guidance on how environmental assessments for IPC should be conducted was available. Several fundamental questions were posed by the legislation and accompanying regulations i.e., how should an operator demonstrate that the choice of process represented the Best Practicable Environmental Option in accordance with section 7 (7) of the Environmental Protection Act 1990? Also, what kind of environmental information should an operator provide to demonstrate that no harmful effects on the environment occur? And how should inspectors use this information in determining an IPC application.

The answers to these and related questions are by no means straightfoward as recent experience shows. According to a recent study of the applications for which authorisations were issued by 1 April 1993, only 37% modelled the dispersion releases, and only 23% contained any background environmental data such as ambient pollution levels. Just 12.5% of applicants offered any meaningful assessment of the impact on the local environment and eco-systems. Very few considered the risks of groundwater or site contamination. The ENDS reports goes on to say that most applicants have failed to demonstrate that releases will be rendered harmless and that only 24% of applicants gave even a brief consideration of the best practicable environmental option.

The challenges facing operators and the Inspectorate was how to provide the kind of environmental information demanded by the legislation? It is clear from the objectives given in s.7 of the Environmental Protection Act (1990) that a means for assessing harm is required by HMIP for use in making regulatory judgements. Within the context of the Act ‘harm’ means:

'harm to the health of living organisms or other interference with the ecological systems of which they form a part and, in the case of man, includes offence caused to any of his senses or harm to his property; and 'harmless' has a corresponding meaning'.

However, the Act does not define the nature of the effects which may be considered harmful or the level in the environment at which they may occur. Therefore, to overcome these difficulties a practical approach to the assessment of harm has been devised and is described in the following section.

The proposed method for assessing the level of harm caused by individual releases is illustrated in Figure 2.

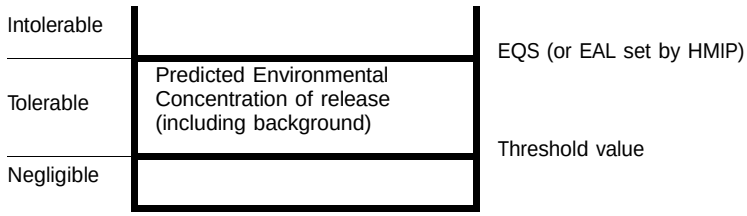

Figure 2. Basis for decisions on the acceptability of releases.

The **intolerable level** is defined by either a statutory limit such as an Environmental Quality Standard for releases to air or an Environmental Quality Objective for those to water. In the absence of a statutory limit for a substance, an interim, **Regulatory Assessment Level (RAL)**, will be set by HMIP. The RAL would provide **guidance** to operators and inspectors on the maximum tolerable environmental concentration of a pollutant. The exact basis for setting an RAL needs to be agreed, but it might be envisaged that they would be set with the eventual EQS in mind.

The **threshold value** used to determine whether or not a release is significant is set at a level where we are confident that the effect on the environment is negligible. An example might be a factor of 100 less than the EQS (or RAL). Again the threshold value would be developed by HMIP as a guide to operators and site inspectors.

6.2 Best Practicable Environmental Option (BPEO)

Where a process involves the release of substances to more than one environmental medium the Inspector will need to determine whether the proposed operation represents the BPEO for the pollutants concerned. The BPEO can be considered as:

"the option which for a given set of objectives, provides the most benefit or least damage to the environmental as a whole, at acceptable cost, in the long term as well as the short term, *as a result of releases of substances from a prescribed process*".

The modification, highlighted by italics, has been added to bring the definition explicitly within the context of Section 7(7) of the Environmental Protection Act which limits the scope of the BPEO to consideration of substances released by the process.

The approach outlined above to assess the tolerability of releases can be used to assess the **Best Practicable Environmental Option**. Where tolerable significant releases occur (see Figure 2) to more than one environmental medium we can compare process/abatement options in an overall environmental (BPEO) context. Each significant release can be normalised by expressing the predicted environmental concentration as a percentage (or proportion) of the EQS (or Regulatory Assessment Level). The proportion of the EQS/RAL utilised by each significant release can be

summed to create a tolerability quotient (TQ) for each medium, which is then used to derive a BPEO index for a specific process/abatement option. This index would be used to establish the best option from an environmental protection viewpoint.

6.3 Tolerability quotients and the BPEO

i) For a tolerable single release

$$TQ = \frac{PEC}{StatutoryLimit}$$ (PEC - Predicted Env. Concentration)

ii) TQ for all tolerable significant releases to an environmental medium

$$TQ^{(AIR)} = TQ_a + TQ_b ... + TQ_i \quad \text{(for a + b ...i releases)}$$

iii) BPEO Index

$$BPEO_{(index)} = TQ^{(AIR)} + TQ^{(WATER)} + TQ^{(LAND)}$$

iv) Best environmental option (BEO) from a range of environmentally tolerable options.

BEO = Lowest BPEO index

6.4 Site specific BATNEEC

The BPEO index would be used for comparative purposes when examining the economic or NEEC aspects to determine the site specific BATNEEC option.

7 ENVIRONMENTAL ASSESSMENT PROCEDURE

Having established the main principles, it is necessary to develop a robust regulatory procedure. This should minimise the effort required by operators in preparing an application and by inspectors in assessing and confirming BATNEEC. It should also provide an audit trail documenting how the key decisions are reached. The stages in the procedure are as follows:

STAGE 1: SELECT PRACTICABLE PROCESS/ABATEMENT OPTIONS

The operator should select a range of techniques to be examined. These should be consistent with standards outlined in the appropriate Chief Inspectors Guidance Notes. Each option would be examined under Stage II.

STAGE II: ENVIRONMENTAL (BPEO) ASSESSMENT

Step 1: Identify pollutants released
For a specific process/abatement option identify the unavoidable releases of prescribed (and other potentially harmful) substances. Establish the release rates under start up, normal and abnormal operation.

Step 2: Compute predicted environmental concentrations (PEC) to establish significant releases.

Use basic dispersion models to predict the maximum environmental concentration of each release. Add to this the actual or estimated background concentration of the pollutant at that point.

Compare the predicted environmental concentration for each release with any statutory limit (EQS), or regulatory ceiling (EAL) and the threshold level. (Those options resulting in a breach of the statutory limit would be automatically discounted). Those releases above the threshold level are the significant releases, as indicated in Figure 3. Where a release results in a particularly high PEC compared with the environmental standard, the Inspectorate might wish to examine this in more detail to reduce any uncertainties and to examine alternative process/abatement options.

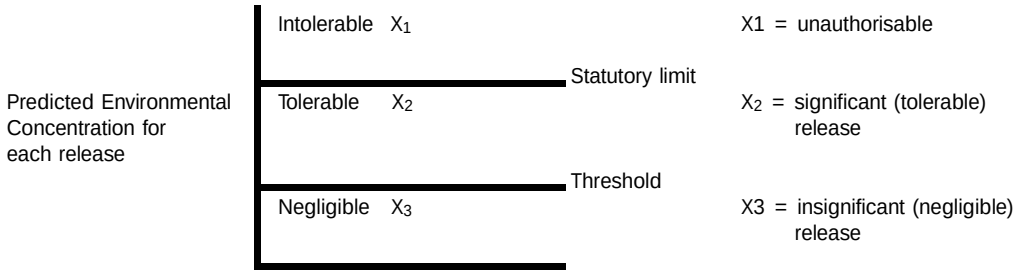

Figure 3. Tolerability of releases from prescribed processes.

Step 3: For significant releases establish the normalised tolerability quotient and calculate the BPEO index.

The PECs for significant release should be confirmed using more comprehensive predictive models. Releases normalised as a percentage of the statutory limit (or interim Environmental Assessment Level, EAL) to give the Tolerability Quotient (TQ). TQs for significant releases to all media summed to give the BPEO index.

STAGE III: DETERMINE SITE SPECIFIC BATNEEC OPTION

From the range of environmentally tolerable options select the site specific BATNEEC Option. If the choice has the lowest BPEO index (greatest environmental protection) then no comparative economic analysis is needed. If not, then the reason for rejecting the more environmentally beneficial options should be justified in terms of cost effectiveness.

No formal rule for selecting the BPEO option can be prescribed, expert judgement will almost always be necessary. However the application of cost-effectiveness analysis assists the operator by identifying a 'break-point' where the costs of further reductions in pollution potential start to rise significantly. To do this it is important to have a quantitative measure of the environmental consequences of the releases involved. This can be done by utilizing the information on the relative harm of different releases to derive an integrated environmental index. Figure 4 shows the costs and environmental effects (indices) for a range of different process options/techniques, 0 to 4, for a hypothetical product.

A BPEO or environmental index derived from emission levels is shown for each option, including the current operation which is the base case. The operator might consider Option 3 as representing the site-specific BPEO even though Option 4 has a better BPEO index value, on the basis of the higher incremental cost entailed at that site in attaining the environmental benefit of Option 4.

Table 1 is an example of how the incremental costs of pollution control can be demonstrated. Other things being equal, in this case it might be be concluded that the site-specific BATNEEC is option 3, because of the doubling of incremental cost to achieve any greater improvement.

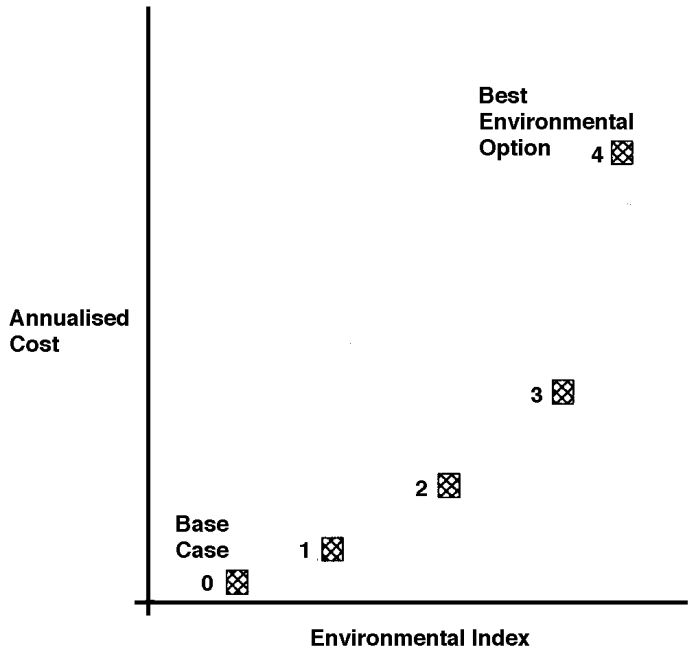

Figure 4. Principles for establishing the site-specific BATNEEC option.

Table 1. Illustration of the Incremental Cost of Pollution Control

Option	Equivalent Annual Cost	Incremental improvement in BPEO Index	Incremental Cost
Base case (uncontrolled)	£0	—	—
Option 1	£20,000	1	£20,000
Option 2	£50,000	1	£30,000
Option 3	£100,000	1	£50,000
Option 4	£200,000	1	£100,000

CONCLUSION

HMIP is developing its portfolio of information about the technology available for pollution abatement of industrial processes with a view to providing its inspectors with guidelines on internationally recognised standards of good practice. HMIP is also planning a research programme to establish methods of characterising and quantifying the impact of pollutants on air, land, or water to allow comparative evaluation of cross-media process options. This is in addition to an extensive programme of research to assess the impact of alternative radioactive waste disposal systems.

REFERENCES

1. The Environmental Protection Act 1990, HMSO.
2. The Environmental Protection (Prescribed Processes and Substances) Regulations 1991 Sl No 472, as amended by the Environmental Protection (Prescribed Processes and Substances) (Amendment) Regulations 1992, SI No 614, HMSO.
3. Integrated Pollution Control - A Practical Guide, Department of the Environment, Marsham Street, London.

ANNEX 1

TIMETABLE FOR IMPLEMENTING INTEGRATED POLLUTION CONTROL

EPA Sched. 1 Ref	Process	Comes within IPC	Apply Between	Chief Inspector's Guidance Note Issued*
	Fuel & Power Industry			
1.3	Combustion (>50MWth) Boilers and Furnaces	1.4.91	1.4.91 & 30.4.91	1.4.91
1.1	Gasification	1.4.92	1.4.92 & 30.6.92	1.2.92
1.2	Carbonisation	1.4.92	1.4.92 & 30.6.92	1.2.92
1.3	Combustion (remainder)	1.4.92	1.4.92 & 30.6.92	1.2.92
1.4	Petroleum	1.4.92	1.4.92 & 30.6.92	1.2.92
	Waste Disposal Industry			
5.1	Incineration	1.8.92	1.8.92 & 31.10.92	1.4.92
5.2	Chemical Recovery	1.8.92	1.8.92 & 31.10.92	1.4.92
5.3	Waste Derived Fuel	1.8.92	1.8.92 & 31.10.92	1.4.92
	Mineral Industry			
3.1	Cement	1.12.92	1.12.92 & 28.2.93	1.6.92
3.2	Asbestos	1.12.92	1.12.92 & 28.2.93	1.6.92
3.3	Fibre	1.12.92	1.12.92 & 28.2.93	1.6.92
3.5	Glass	1.12.92	1.12.92 & 28.2.93	1.6.92
3.6	Ceramic	1.12.92	1.12.92 & 28.2.93	1.6.92
	Chemical Industry			
4.1	Petrochemical	1.5.93	1.5.93 & 31.10.93	1.11.92
4.2	Organic	1.5.93	1.5.93 & 31.10.93	1.11.92
4.7	Chemical Pesticide	1.5.93	1.5.93 & 31.10.93	1.11.92
4.8	Pharmaceutical	1.5.93	1.5.93 & 31.10.93	1.11.92
4.3	Acid Manufacturing	1.11.93	1.11.93 & 31.1.94	1.5.93
4.4	Halogen	1.11.93	1.11.93 & 31.1.94	1.5.93
4.6	Chemical Fertiliser	1.11.93	1.11.93 & 31.1.94	1.5.93
4.9	Bulk Chemical Storage	1.11.93	1.11.93 & 31.1.94	1.5.93
4.5	Inorganic Chemical	1.5.94	1.5.94 & 31.7.94	1.11.93

ANNEX 1 (continued)

EPA Sched. 1 Ref	Process	Comes within IPC	Apply Between	Chief Inspector's Guidance Note Issued*
	Metal Industry			
2.1	Iron and Steel	1.1.95	1.1.95 & 31.3.95	1.7.94
2.3	Smelting	1.1.95	1.1.95 & 31.3.95	1.7.94
2.2	Non-ferrous	1.5.95	1.5.95 & 31.7.95	1.11.94
	Other Industry			
6.1	Paper Manufacturing	1.11.95	1.11.95 & 31.1.96	1.5.95
6.2	Di-isocynate	1.11.95	1.11.95 & 31.1.96	1.5.95
6.3	Tar and Bitumen	1.11.95	1.11.95 & 31.1.96	1.5.95
6.4	Uranium	1.11.95	1.11.95 & 31.1.96	1.5.95
6.5	Coating	1.11.95	1.11.95 & 31.1.96	1.5.95
6.6	Coating Manufacturing	1.11.95	1.11.95 & 31.1.96	1.5.95
6.7	Timber	1.11.95	1.11.95 & 31.1.96	1.5.95
6.9	Animal and Plant Treatment	1.11.95	1.11.95 & 31.1.96	1.5.95

* Target date

ANNEX 2

PRESCRIBED SUBSTANCES

Release to air: Prescribed substances

Oxides of sulphur and other sulphur compounds
Oxides of nitrogen and other nitrogen compounds
Oxides of carbon
Organic compounds and partial oxidation products
Metals, metalloids and their compounds
Asbestos (suspended particulate matter and fibres), glass fibres and mineral fibres
Halogens and their compounds
Phosphorus and its compounds
Particulate matter

Release to water: Prescribed substances

Mercury and its compounds
cadmium and its compounds
All isomers of hexachlorocyclohexane
All isomers of DDT
Pentachlorophenol and its compounds
Hexachlorobenzene
Hexachlorobutadiene
Aldrin
Dieldrin
Endrin
Polychlorinated Biphenyls
Dichlorvos
1,2-Dichloroethane
All isomers of Trichlorobenzene
Atrazine
Simazine
Tributyltin compounds
Triphenyltin compounds
Trifluralin
Fenitrothion
Azinphos-methyl
Malathion
Endosulfan

Release to land: Prescribed substances

Organic solvents
Azides
Halogens and their covalent compounds
Metal carbonyls
Organo-metallic compounds
Oxidising agents
Polychlorinated dibenzofuran and any congener thereof
Polychlorinated dibenzo-p-dioxin and any other congener thereof

Polyhalogenated biphenyls, terphenyls and naphthalenes
Phosphorus

Pesticides, that is to say, any chemical substance or preparation prepared or used for destroying any pest, including those used for protecting plants or wood or other plant products from harmful organisms; regulating the growth of plants; giving protection against harmful or unwanted effects on water systems, buildings or other structures, or on manufactured products; or protecting animals against ectoparasites.

Alkali metals and their oxides and alkaline earth metals and their oxides.