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RSR : Principles of optimisation in the management and disposal of radioactive waste

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RSR: Principles of optimisation in the management and disposal of radioactive waste: a quick guide.

This guidance gives an overview of the principles of optimisation in the management and disposal of radioactive waste from radioactive substances activities.

Operators, when disposing of radioactive waste, need to ensure that the radiological impacts on people are kept as low as reasonably achievable, taking into account economic and social factors. This is the optimisation requirement. We expect operators to achieve this through the use of “best available techniques” (BAT) in the relation to the management of the generation and disposal of radioactive waste.

This guidance sets out the principles and framework for undertaking studies on optimisation and the identification of BAT. It refers to other guidance such as guidance on options studies and the assessment of radiological dose impacts, which operators may need to undertake as part of the overall assessment.

There is separate guidance on this subject for the non-nuclear sector, and for the near - surface and deep geological disposal of solid radioactive waste. However, this document may also be of interest to operators in these areas.

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1 Introduction

About this guidance

This document provides guidance to our regulators and operators on the optimisation of the management of the generation and disposal of radioactive waste such that

“all exposures to ionising radiation of any member of the public and the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable (ALARA), taking into account economic and social factors” .

“Optimisation” is the process whereby an operator selects the management option and the practices applied that best meet the full range of relevant health, safety, environmental and security (including safeguards) principles and criteria, taking into account all relevant factors, eg social and economic considerations. Different regulatory regimes in the field of radiological protection use different terminology and have their own guidance on this topic, namely: reducing risks as low as reasonably practicable (ALARP); use of best practicable means (BPM) and best practicable environment option (BPEO); and now, in England and Wales, use of best available techniques (BAT). However, all of the above involve the same process, ie making a judgement between options by comparing benefits in terms of safety, environmental protection etc, and costs in terms of time, effort or money. Some of our guidance, including joint guidance with other regulators, uses the expression “optimisation” as a common term rather than referring to regime-specific terms, and we have accordingly used this term in this guidance.

In this document, we refer to “best available techniques” (BAT) as the means an operator uses in the operation of a facility to deliver an optimised outcome, ie to reduce exposures to ALARA. For clarity, BAT are the means (for example plant and processes) the operator uses to control disposals of radioactive waste into the environment. BAT is within the control of the operator and is how the operator seeks to demonstrate that doses to the public, which are normally outwith his control, are kept to ALARA.

We and SEPA consider BAT and BPM (which remains in force in Scotland) to be equivalent terms with essentially the same assessment and determination processes and which deliver the equivalent level of environmental protection.

What constitutes BAT and an optimised outcome will evolve over time, to reflect changes in, for example, technology, knowledge and local environmental issues. This means that the operator must keep these matters under review and be ready to implement changes.

“Optimisation” applies only to radiological risks to any member of the public and the population as a whole. Other living organisms must also be protected from radiological risks but there is no optimisation requirement.

When undertaking optimisation studies, operators will need to identify how radioactive wastes will arise, be managed and be disposed of throughout the lifecycle of the facility, and will need to be able to quantify such arisings and disposals.

This guidance describes the process of optimisation and the matters which need to be considered as part of that process. It does not provide technical guidance or set specific standards.

Who is this guidance for?

Applicants and operators should read this guidance when applying for an environmental permit to dispose of radioactive waste, a variation to a permit for the disposal of radioactive waste, or when reviewing current arrangements. This guidance describes the concept of optimisation as it applies across both the nuclear and non-nuclear sectors. There is also more specific and detailed guidance for certain activities, as described in the next section.

Are there special arrangements for your activity?

We have developed separate guidance on the requirements for authorisation for radioactive waste in relation to

- [Near surface disposal facilities on land for solid radioactive waste](#) ;
- [Geological disposal facilities on land for solid radioactive waste](#); and
- Disposals of radioactive waste in the non-nuclear sector.

Operators of those facilities should refer to and follow those guidance documents. However, this guidance may also be of interest to operators of such facilities.

How this guidance is structured

This guidance sets out a generic approach to the requirements for optimisation, making use of other documentation as far as possible. In this document we describe

- the legal and policy framework;
- considerations in relation to achieving a balance;
- principles for optimisation;
- the process for optimisation and the determination of BAT.

Optimisation involves considering and balancing radiological risks and impacts in a range of different situations, from small-scale use of radioactive materials in hospitals to large-scale operational plant, such as nuclear power stations and nuclear decommissioning and clean-up activities. For all of these situations, operators need to have appropriate decision-making processes in place, and involve the appropriate people in those processes, to address optimisation effectively. In this document we have therefore set out general principles and a framework for qualitative decision-making that will be rigorous and defensible, taken from our RSR Environmental Principles (REPs). We describe this framework in terms of

- 1) setting up the necessary management arrangements, including selecting the staff to be involved;
- 2) undertaking a proportionate and systematic determination of BAT;
- 3) recording and justifying the optimised outcome;
- 4) implementing the optimised outcome, subject to any necessary regulatory approval; and
- 5) keeping BAT under review.

We take a proportionate approach in relation to

- the degree of assessment and demonstration we require of operators and undertake ourselves; and
- the techniques we require operators to use.

Consequently the demonstration of optimisation may vary from a detailed study involving options assessment, selection and minimisation for the operation of a nuclear facility, to a short description of operation in accordance with recognised standards and guidance for a small user. But in all cases the overall assessment process can be described very simply as

- asking if there is anything further that can be done to reduce doses to people; and
- then implementing that unless the associated detriments are grossly disproportionate to the benefits gained.

In other words, BAT is the point at which the detriments from implementing further techniques become grossly disproportionate to the benefits gained. Such an assessment does not necessarily need complicated cost-benefit analysis. The use of experienced people, ownership, sound judgement and a clear, logical argument may be sufficient to make a successful case.

In some cases it may also be necessary to undertake other risk assessments in relation to the conventional (non-radiological) properties of the waste being disposed of. The operator should then follow the appropriate guidance in H1; Environment Risk Assessment.

Terms and expressions in this document are defined in the glossary to the REPs.

2 The legal and policy framework for optimisation

The Environmental Permitting Regulations 2010 provide the legal framework for the regulation of activities involving the use of radioactive substances and giving rise to the generation and release of radioactive waste. Schedule 23 Part 3 of the Regulations implements the relevant requirements of the Basic Safety Standards (BSS) Directive, namely that in relation to radioactive waste we must exercise our functions to ensure that;

- *all exposures to ionising radiation of any member of the public and of the population as a whole resulting from the disposal of radioactive waste are kept as low as reasonably achievable, economic and social factors being taken into account (ALARA) ; and*
- *the sum of all doses resulting from the exposure of any member of the public shall not exceed specified dose limits.*

The Government's EPP RSR guidance summarises Government policies which bear on the management of the generation and disposal of radioactive waste. Both we and operators need to have regard to these policies when considering optimisation and the use of BAT. Ministers have recently issued [Statutory Guidance](#) to the Environment Agency concerning the regulation of radioactive discharges into the environment. This requires that we ensure operators use BAT in order to

- prevent the unnecessary creation of wastes or discharges;
- minimise waste generation;
- minimise the radiological impact of discharges on people and the environment.

This applies to both radioactive content and the quantity (volume and mass) of waste produced. This is Government's statement on what operators need to do to achieve ALARA and these are therefore the key demonstrations that we expect operators to make in demonstrating an optimised outcome.

The [2009 UK Discharge Strategy](#) and the Statutory Guidance describe more fully the principles and other matters that we and operators need to consider in relation to optimisation and the use of BAT. The principles, in full, are

- sustainable development, meeting the needs of the present without compromising the ability of future generations to meet their own needs and achieving the optimum balance in environmental, social and economic outcomes;
- the use of Best Available Techniques (BAT) in England and Wales to prevent and, where that is not practicable, minimise waste generation and discharges to the environment. The application of BAT is broadly equivalent to a combination of best practicable means (BPM) and best practicable environmental option (BPEO), as described in the 2002 strategy;
- the precautionary principle, that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation";
- the polluter pays principle, by virtue of which the costs of pollution prevention, control and reduction measures are to be borne by the polluter.
- the preferred use of 'concentrate and contain' of radioactive waste over 'dilute and disperse' in cases where there would be a definite benefit in reducing

environmental pollution, provided that BAT is being applied and worker dose is taken into account.

These principles are in addition to the controls of justification, optimisation and the application of limits and conditions.

BAT is defined by the OSPAR convention as set out in Annex A. Techniques include

“both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled”

The use of BAT applies at all stages in the lifetime of a facility, from design, through construction and operation to decommissioning and site restoration, and to the many different activities which comprise its management, operation and maintenance. The use of BAT therefore incorporates the many different techniques and measures that collectively ensure that a facility, as a whole, is operated using BAT. What constitutes BAT will change over the lifetime of a facility, as a result of changes in the nature or scale of the activities undertaken by the facility, by developments in the techniques available and possibly by external changes around the facility.

We will follow developments in BAT and expect operators to adopt these, where appropriate. However, we recognise that it may not be cost effective or practical to upgrade existing facilities to the latest standards, either fully or in part.

The Government expects the use of BAT by operators to meet the UK discharge strategy and in general to meet the requirements of the BSS Directive. However, where any statutory obligation requires stricter conditions and limits than those achievable by the use of BAT then we must ensure that operators apply the necessary additional measures and controls.

The definition of BAT refers to the “economic feasibility of techniques”. We consider that this represents the same balance of detriments and benefits as described by the “not grossly disproportionate” test in relation to “best practical means” (BPM). For continuity and consistency with SEPA and the HSE, we will continue to use the expression “not grossly disproportionate” when comparing risks to be avoided and the detriment in implementing further risk reduction.

“risk” in the context of optimisation includes the concept of danger and so the determination of BAT needs to have regard to both hazard and risk, as relevant. The definition of risk in our REPs therefore include both concepts, ie

“In this context, [risk is] an assessment informed by:

- o the identification of a potential for causing harm, arising from an intrinsic property or disposition of something to cause detriment, and an assessment of its magnitude – “the hazard”; and*
- o an evaluation of the likelihood that this hazard might occur.*

In assessing risk appropriate attention should be given to each of these factors

And we use “risk” in that sense in this document.

3 The judgements to be made.

"Optimisation" means judgements have to be made about the relative significance of various issues, including

- the number of people (workers and the public) and other environmental targets that may be exposed to radiological risk;
- the likelihood that they could be exposed to radiation, where exposure is not certain to happen;
- the magnitude and distribution in time and space of radiation doses that they will or could receive;
- nuclear security and safeguards requirements;
- issues similar to those above, but relating to non-radiological hazards;
- economic, societal and environmental factors;
- technical viability;
- uncertainties in any of the above.

The wider environmental, social and economic considerations are described in more detail in Chapter 3 "Achieving a balance" of the [2009 Discharge Strategy](#). Optimisation is not just about minimisation of the environmental impact of the disposal of radioactive waste. Instead, minimisation must be consistent with meeting other obligations, such as worker protection and other relevant considerations.

To do this, operators need to compare different considerations and risks. This may be done on a qualitative basis or a quantitative basis, such as by expressing risks and benefits in monetary terms. The latter also provides a basis for cost-benefit analysis, based on whether the costs of implementing specific control techniques are economically acceptable, ie not grossly disproportionate. We recognise that cost benefit analysis has a role but there are many difficulties in such an approach, such as

- ascribing monetary values to many of these factors, which are often largely subjective ;
- comparing dissimilar risks and impacts;
- the importance of societal expectations;
- the uncertainty in many of these considerations;
- the uncertainty or inappropriateness in applying cost-benefit to issues with a potential impact over very long periods of time;
- the uncertainty in what gross disproportion factor to apply.

Therefore we expect that cost-benefit analysis, even where it can be carried out, will be only one of the factors in determining an optimised outcome. Instead this guidance is based on a qualitative approach, in which decisions on optimisation and the use of BAT are made through a proportionate and systematic decision-making process based on the use of our REPs.

4 Principles for optimisation

As noted above, this document sets out the principles and process for determining an optimised outcome using a qualitative approach to decision-making. Principle RSMDP4 in our REPs describes the methodology for assessing BAT.

Principle RSMDP4 in our REPs states

The best available techniques should be identified by a methodology that is timely, transparent, inclusive, based on good quality data, and properly documented.

The considerations in applying RSMDP4 are:

- The process to identify the best available techniques should be carried out by competent, properly informed personnel who have relevant expertise and involve strategic decision makers.
- The resources used in the process to identify the best available techniques should be proportionate to the environmental benefits or potential environmental benefits to be derived.
- The process to identify the best available techniques should be initiated:
 - For new sites or facilities at an early stage when options are being conceived, evaluated and decided on;
 - For existing sites or facilities, when modifications to scope or function are proposed or expected and when options are being conceived, evaluated and decided on;
 - When there are significant reasons to believe that substantially better options might be available;
 - On a periodic basis or as and when new or important information comes to light.
- The process to identify the best available techniques should be transparent such that:
 - The process is properly documented, is transparent and is capable of review;
 - The decision to be made is clear;
 - The scope of the study is clear and all boundaries and constraints relevant to the decision to be made are set out and agreed by those undertaking the process;
 - All assumptions are set out plainly, together with the data and basis on which they have been made;
 - Sufficient information is provided to confirm the validity of all data used; and
 - The conclusion arrived at has integrity and can be substantiated, i.e. it is rational, equitable and defensible.
- The process to identify the best available techniques should be inclusive such that the extent to which stakeholders are involved reflects:

- The technical and societal significance and human health and environmental implications of the decision;
 - The information that stakeholders can bring to the process;
 - What the impact on the process and its conclusion might be of a wider range of stakeholder perspectives, established for example through sensitivity studies;
 - Whether stakeholder “ownership” of the process is an objective; and
 - The need for wider confidence in the process.
- The process to identify the best available techniques should use robust data and in particular:
 - All data should be at a level of detail that ensures that it is fit for purpose;
 - Relevant information and data should be identified and considered;
 - Where there is significant uncertainty about the data used this shall be taken account of within the process. Where there is significant uncertainty in key data associated with particular options then it may be appropriate that such options are screened out of further consideration at an early stage or further work to reduce the uncertainty is undertaken or that a range of conclusions are reached dependent on the outcome of such uncertainties.
 - The process to identify the best available techniques shall be properly documented such that there is sufficient detail to support the conclusions reached.

The other principal REPs in relation to BAT are

RPDP1: all exposures to ionising radiation of any member of the public and the population as a whole shall be kept as low as reasonably achievable (ALARA), economic and social factors being taken into consideration.

RSMDP3: the best available techniques should be used to ensure that the production of radioactive waste is prevented and where that is not practicable, minimised with regard to activity and quantity.

RSMDP7: when making decisions about the management of radioactive waste, the best available techniques should be used to ensure that the resulting environmental risk and impact are minimised.

However, many other principles will be relevant to specific aspect of the facility being assessed. The following REPS refer to certain strategies or plans in relation to the management of radioactive waste. These strategies or plans will need to be based on the use of BAT.

RSMDP1: A Strategy should be produced for the management of all radioactive substances.

DEDP1: Each site should have a decommissioning strategy that is updated and refined at appropriate intervals.

DEDP2: There should be a decommissioning plan for each facility and this should be updated and refined through its operating life and during decommissioning.

5 Process for optimisation and the determination of BAT

In all cases it is the responsibility of operators to demonstrate to us that they are using BAT to achieve an optimised outcome. In accordance with RSMDP4 we expect an operator to determine BAT within the following decision-making process;

- setting up the necessary management arrangements, including selecting the staff with appropriate experience and qualifications to be involved;
- undertaking a proportionate and systematic determination of BAT;
- recording and justifying the preferred outcome and other information pertinent to the decision-making processes;
- implementing the preferred outcome, subject to any necessary regulatory approval;
- keeping BAT under review.

We have described the decision-making process in this way for convenience of presentation. It is a matter for operators how they structure their approach providing they meet our overall requirements in RSMPD4 and other principles.

Step 1: Management arrangements

RSMDP4 sets out our expectations with regard to the management arrangements that operators should have in place to undertake BAT assessments. We would emphasise that operators need to have in place

- documented management arrangements which identify either the frequency or when it is necessary to undertake or review BAT assessments and to initiate such work when necessary;
- documented management arrangements for how such assessments will be undertaken, reviewed and approved.

Step 2: Undertaking the BAT assessment

RSMDP3, 6 and 7 set out the key expectations with regard to the use of BAT to prevent and where that is not practicable to minimise the production of radioactivity and the quantity/volume of radioactive waste. Operators must show

- that they have selected the option, which best protects people and the environment as a whole in both the short and long term; and
- that they have optimised the environmental impact of the preferred option, through the choice of techniques proposed for its operation, maintenance etc.

In doing this the operator should seek to

- prevent the unnecessary creation of waste or discharges;
- minimise waste generation; and
- minimise the impact of discharges on people and the environment;
- on the basis that the operators use relevant good practice, as a whole.

An operator should therefore undertake options appraisal to determine what is practicable in terms of optimisation and the techniques to achieve this. Note that there will generally be options at various points in the overall optimisation process and hence the need to

consider options appraisal throughout. The selection process should consider identification of options and appraisal of their environmental impact, taking into consideration practicality, cost benefit and the wider social and economic factors as appropriate. In particular the operator will need to consider the balance between a concentrate and contain approach and a dilute and disperse approach to the disposal of radioactive waste.

In doing this the operator will need to consider the options affecting how waste will arise, be managed, discharged and disposed of throughout the lifecycle of the facility and will need to quantify the waste arisings and disposals and their resulting radiological impacts.

Key points in relation to options appraisal are;

- its purpose is to inform what is practicable, and to assist in the wider decision-making process to identify the best available option;
- options assessment should be carried out on the assumption that waste creation has been minimised through the use of relevant good practice in relation to the design, operation and decommissioning of the facility;
- operators should undertake options assessment in a systematic, consistent manner, including, where relevant, options screening, analysis, weighing of options and identification of the best option. It should follow the generic framework set out in the environment agencies' [Guidance for the Environment Agencies' Assessment of Best Practicable Environmental Option Studies at Nuclear Sites](#);
- Options assessments will generally require the use of data on radiological impact. While individual dose will be the primary factor, collective dose may be used as an additional discriminator. Operators should assess the radiological impact as described in the [Principles for the assessment of prospective public doses](#);
- Options assessments need to consider all relevant legal and policy, societal and economic considerations;
- Options assessments need to identify and consider all relevant risks, impacts and uncertainties;
- Our expectations for stakeholder involvement in strategy development and option studies at nuclear sites are set out in the document [Guidance for the Environment Agencies' Assessment of Best Practicable Environmental Option Studies at Nuclear Sites](#).

In demonstrating BAT, the operator should have regard to the use of standards, guidance and relevant good practice. We expect operators to adopt and implement such standards, guidance and relevant good practice unless they can justify that alternative measures provide a similar level of protection or performance. This applies to all aspects of operation, including matters such as sampling and monitoring, managements systems, maintenance, record keeping etc. Cost-benefit analysis should not be used as an argument by operators to avoid the use of relevant good practice.

In general terms, sources of such guidance and good practice may include

- Government Policy (eg UK Discharge Strategy);
- Environment Agency Guidance (including joint guidance with the HSE/SEPA);
- Codes of Practice;
- Standards (whether international or national or trade);
- Company standards/procedures ;
- Working practices, processes and techniques.

The HSE-ND guidance on the demonstration of ALARP (as low as reasonably practicable) gives guidance on the use of relevant good practice and on assessing whether such guidance is and remains relevant and good.

Operators may seek to argue that the adoption and implementation of our guidance and relevant good practice represents BAT without the need for more detailed consideration of options appraisal and optimisation. This approach is acceptable, providing that the operator demonstrates that the guidance and good practice is relevant and comprehensive for the facility in question. This approach may be adopted for parts of a facility or all of it depending on the guidance available.

When assessing BAT the operator should consider the environmental context in which the facility will operate and take into consideration local factors such as local populations and sensitivity of environmental receptors to determine whether these require the use of additional or different techniques.

Some sites may consist of two or more facilities (as defined in the REPs glossary), and the operator may assess BAT on a facility rather a site-wide basis. This is acceptable. However, the operator must ensure that facility-based BAT assessments consider wider site issues, to ensure that BAT is identified and applied across the site as a whole.

A key consideration in determining BAT is the issue of uncertainty. There is, in general, a need to consider uncertainties in determining BAT and to consider and incorporate contingency arrangements as necessary to ensure a robust BAT assessment and robust implementation. This is particularly relevant for nuclear decommissioning, where there may be considerable uncertainty about the amount and nature of radioactivity present, the effectiveness of proposed treatment options, and a staged decommissioning process which may extend over many decades, with uncertainty about the later stages of the process.

There is no lower threshold, in terms of dose to the public, at which the techniques in place can be presumed or assumed to be BAT, simply because of their resulting impact. Therefore, an operator cannot justify his facility as being BAT solely by reference to the level of discharges or their impact.

If any benefit or reduction in detriment, however small, can be achieved using little or no additional resources, then it should be secured. Conversely techniques may be rejected as BAT if the costs are grossly disproportionate to the environmental benefits.

The lack of profitability of a particular business should not affect the assessment. For example, if it has been established that a particular technique is BAT for comparable facilities or operations, then all operators of the comparable facilities would normally be expected to adopt that technique. There may be some cases where different techniques would apply because of, for example

- the balance of costs and benefits is different in the particular local environment;
- the technical circumstances of a particular facility, including its age and its remaining expected operating life; and
- different local safety, social and economic considerations.

However, it would not be right for us to accept lower standards, or to delay the implementation of BAT, solely because an operator argued for this narrowly on the basis of his own financial position. Conversely, we should not impose stricter standards than BAT just because an operator can afford to pay more.

The above approach applies to both new and existing facilities; however, the outcomes may be different. In general, new facilities will normally be expected fully to comply with relevant good practice and guidance as a minimum; however site-specific factors may require additional measures. For an existing facility, the operator should compare the facility with any relevant guidance and good practice, consider the importance of any

shortfalls and make proposals for improvement taking into consideration the normal issues, including costs and benefits. In this case, facility-specific considerations, including consideration of the projected life-time of the facility, may lead to different conclusions on grounds of cost. In any event the operator of an existing facility should justify that the techniques being used represent the use of BAT, taking into consideration environmental benefits, the timescales for any proposed or potential improvements, and their costs in that specific case.

Step 3: Recording and justifying the optimised outcomes

Operators should maintain a written demonstration that the relevant standards and requirements have been met and the activities optimised to reduce exposures to ALARA. RSM DP4 sets out our requirements for recording the process of assessment and the outcomes. We would emphasise that

- the process should be properly documented such that there is sufficient detail to support the conclusions reached;
- the conclusion arrived at should have integrity, i.e. it is rational, equitable and defensible.

Operators need to provide us a written summary submission on optimisation and to justify the techniques proposed as BAT when

- making an application for a new permit;
- for variations where these may have significant impact of the management and disposal of radioactive wastes.

Operators may also need to provide us with an updated submission following review and revision of their current arrangements. The application form and supporting guidance and other related guidance provide more detail on the information to be provided.

Step 4 Implementing BAT

Following internal approval and regulatory approval where necessary, the operator must put in place and implement the management systems in order to operate the facility in accordance with the conditions of his permit including the use of BAT. The operator must ensure that the processes, techniques, procedures etc that constitute BAT are consistently and properly implemented at all times.

We will normally regard any failure by an operator to properly implement the management system, techniques, procedures etc constituting BAT as a breach of the relevant permit condition(s). An operator cannot defend any such error, omission or violation on their part on the basis that these did not affect discharges or the resulting radiological impact. For example, an increase in releases as a result of an operator failing to follow operating procedures should be regarded as a failure to use BAT. It would not be correct to accept an argument that because the releases and resulting dose had been small (or even zero) that it would not have been worth spending more on, say, training to ensure proper implementation of BAT.

Operators should also use BAT (and have ready appropriate instructions etc as part of their management systems) to ensure that wastes arising from accidents or maloperations are minimised and disposed of to meet the requirement for optimisation.

Step 5 Keeping BAT under review

The operator should review the use of BAT in response to

- changes in legislation or policy;
- new facts or new knowledge about impacts on people and the environment;
- technical developments;
- when processes or operations change eg from operating to decommissioning.

where any of these could have a significant impact on the management and disposal of radioactive waste, the impact on people and the environment, and compliance with permit conditions. When the operator identifies the need to review BAT, it should repeat steps 2 and 3 as proportionate and relevant. That is, the operator may restrict the review to those aspects of his facility affected by the changes, rather than the whole facility. The operator should also consider the cumulative effects of small changes over time. On completion of the review the operator should update his record of his BAT assessment (step 3) and should implement the changes, subject to any necessary internal and regulatory approvals (step 4).

Annex A: Definition of BAT

BAT is defined as

The use of the best available techniques shall emphasise the use of non-waste technology, if available.

The term "best available techniques" means the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. In determining whether a set of processes, facilities and methods of operation constitute the best available techniques in general or individual cases, special consideration shall be given to:

- a) comparable processes, facilities or methods of operation which have recently been successfully tried out;*
- b) technological advances and changes in scientific knowledge and understanding;*
- c) the economic feasibility of such techniques;*
- d) time limits for installation in both new and existing plants;*
- e) the nature and volume of the discharges and emissions concerned.*

It therefore follows that what is "best available techniques" for a particular process will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding.

If the reduction of discharges and emissions resulting from the use of best available techniques does not lead to environmentally acceptable results, additional measures have to be applied.

"Techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

Related guidance

Government Guidance on EPP can be found at <http://www.defra.gov.uk/environment/policy/permits/index.htm>

General Environment Agency EPR guidance can be found at <http://www.environment-agency.gov.uk/business/topics/permitting/default.aspx>

General Environment Agency RSR guidance can be found for nuclear sites at <http://www.environment-agency.gov.uk/business/sectors/32517.aspx>

and for non-nuclear sites at <http://www.environment-agency.gov.uk/business/sectors/32481.aspx>

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HSE 2009: *ND guidance on the demonstration of ALARP (as low as reasonably practicable)* (Available at http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/tast005.htm)

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