

New nuclear power stations Generic Design Assessment

Guidance to Requesting Parties

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Introduction

The purpose of this guidance

1 This document provides guidance on the Health and Safety Executive's (HSE's) nuclear power station Generic Design Assessment (GDA) process for safety assessment. This process will be applied where HSE is asked to assess a new reactor design in advance of an application for a nuclear site licence being made. This document is for those parties who ask HSE to undertake such an assessment (the 'Requesting Parties'). It informs Requesting Parties of:

- what HSE expects from them;
- what process HSE will apply, including the possible timescales; and
- what they can expect as outputs from HSE.

2 This guidance has been developed in conjunction with the other principal nuclear regulators in the UK. In applying it to submissions, HSE's Nuclear Installations Inspectorate (NII) will work closely with the other nuclear regulators, including the Environment Agency and the Department for Transport. There is a separate 'top-tier' guidance document, *A guide to the regulatory processes*,¹ which describes how the work of these regulators will be integrated. NII assesses nuclear power station safety cases and HSE's Office for Civil Nuclear Security (OCNS) deals with security matters. OCNS has issued separate guidance for GDA.

Background

3 HSE's expert report to the Government's 2006 Energy Review, *The health and safety risks and regulatory strategy related to energy development*,² looked back at experience of the most recent new reactor assessments in the UK, undertaken for Sizewell B and Hinkley Point C. At Sizewell B, a nuclear site licence application was made in 1981 and was not granted until 1987, shortly after the public inquiry report was issued, with the plant entering full operation in 1995. For Hinkley Point C, the site licence application, based on a design very similar to Sizewell B, was submitted in 1987 and the public inquiry was completed in 1990, at which time the applicant (the Central Electricity Generating Board) was reorganised and the project was halted. However, important lessons were learnt. If a standardised design is used, and the design and safety case are well developed much earlier in the project, the time for regulatory assessment and the regulatory uncertainty for licence applicants will both be reduced.

4 In addition, since 1990, the nuclear and electricity markets have become increasingly internationalised. The operators of nuclear power stations in the UK in the future may well include non-UK companies less familiar with the UK's nuclear regulatory framework, and new reactor build proposals are likely to be based on well-developed 'overseas' designs, which may already be in operation, under construction or licensed by overseas regulators. Furthermore, there is now an understanding that the nuclear regulatory system should reflect more closely the Government's commitment towards openness and transparency in regulatory processes.

5 In response to this previous experience and industry changes, and in anticipation of renewed interest in nuclear power in the UK, HSE proposed that it would revise and update its procedures for granting a licence for the start of construction. HSE proposed a two-phase process: the first phase would be a review of the safety features and ultimate acceptability of a nuclear reactor design

as the basis for granting a nuclear site licence. If successful, this would lead to issue of a statement of 'Design Acceptance' by HSE, which would remain valid for a number of years. The second phase would involve an applicant seeking a nuclear site licence to construct such a reactor at a specific site (or sites).

6 The Government's Energy Review report, published in July 2006,³ welcomed HSE's proposals. It asked HSE to develop a system for assessing nuclear reactor designs, and to publish guidance early in 2007. This document provides that guidance.

7 Earlier in 2006, HSE requested a review from the International Atomic Energy Agency (IAEA) International Regulatory Review Service (IRRS), which considered HSE's readiness to regulate and license any proposed new reactors. The results were reported in the IRRS *Report to the Government of the United Kingdom*⁴ and published on HSE's website, together with HSE's initial response. The IAEA review concluded that the UK system of regulation was flexible and well adapted for dealing with international nuclear industry, but there was a need to develop formal guidance for the assessment process for new reactors. This document provides part of that guidance.

8 In May 2007 the Government published *Meeting the Energy Challenge: A White Paper on Energy*,⁵ and the associated consultation document *The Future of Nuclear Power: The role of nuclear power in a low carbon UK economy*.⁶ The consultation document describes the proposals for government facilitative action, including Generic Design Assessment and Strategic Siting Assessment.

9 In January 2008 the Government published *Meeting the Energy Challenge: A White Paper on nuclear power*⁷ with its response to the consultation, which welcomed the preparation and approach the nuclear regulators have made to secure nuclear health, security and environmental protection in the advent of new build, including the development of the GDA process.

Overall process and timescales

10 Proposals for building new power reactors in the UK may be subject to a multi-stage process with two phases, which may overlap:

- Phase One, Generic Design Assessment, is NII's assessment of the safety case for a generic design, leading to issue of Design Acceptance Confirmation if the outcome is positive;
- Phase Two, nuclear site licensing, is NII's assessment of the application for a nuclear site licence and is therefore site, reactor type and operator specific.

11 This process is presented in Table 1 with approximate timescales. Phase One is divided into four steps, as proposed in the Energy Review. These steps, which culminate in the issuing of a Design Acceptance Confirmation, are described in detail in this document. Specific assessment timetables will be drawn up and agreed by NII and those requesting the work at the beginning of Phase One.

Table 1 Generic Design Assessment and licensing process

Phase		Process	Approximate timescale
Phase One: Generic Design Assessment	1	Design and safety case preparation based on generic site envelope	Requesting Party is responsible
	2	Fundamental safety overview	3–6 months
	3	Overall design safety review	6–12 months
	4	Detailed design assessment, with subsequent issue of Design Acceptance Confirmation if the design is considered acceptable	2 years
Phase Two: Nuclear site licensing		Site licence assessment, with subsequent issue of site licence if application is judged to be acceptable	6–12 months

12 The timescales set out in Table 1 are based on the assumption of assessing a single design. The actual timescales will depend on factors such as:

- the number of designs being assessed in parallel by NII;
- the content, quality and timeliness of the safety submissions received;
- the completeness of the design;
- the significance of any assessment issues arising;
- the responsiveness of Requesting Parties to NII issues and questions;
- the availability of resource to NII;
- the ability to make best use of information from overseas nuclear regulators;
- NII's experience with similar reactor designs; and
- the extent of the early engagement on licensing and organisational matters.

13 The assumption is that all the documentation required is available at the start of each step. If documentation is submitted piecemeal, this may have an effect on the schedule, and needs to be discussed with NII.

Key features of the Generic Design Assessment process

14 The GDA process described in this guidance:

- gives clarity of NII's requirements, processes and timescales;
- allows for submission of an international standard design (with potential benefits of standardisation);
- permits potential significant use of international standard safety cases;
- allows for a stepwise reduction in regulatory uncertainty as the project progresses;
- leads to issue of a Design Acceptance Confirmation for use in a subsequent nuclear site licence application (or applications), if the design is considered acceptable;

- includes public involvement; and
- facilitates increased co-ordination between the nuclear regulators.

15 It should be noted, however, that:

- Phase One and Phase Two are separate assessment processes;
- there is no guarantee that the Phase One process will lead to successful Design Acceptance – this will depend on whether the design and submissions meet HSE standards and expectations;
- similarly, a positive Design Acceptance Confirmation does not guarantee that a subsequent Phase Two licensing application will be successful, as the latter phase covers wider issues.

More generally, it must be borne in mind that in the UK nuclear safety of plants is the responsibility of the licensee, and the issue of a Design Acceptance Confirmation or a nuclear site licence does not transfer any portion of this responsibility to NII.

16 This process has been developed in discussion with the Environment Agency and the Department for Transport. It also includes the results of stakeholder interactions with BERR (formerly the Department of Trade and Industry), vendors, current licensees, potential operators and non-governmental organisations. The Environment Agency has developed similar processes.

Objectives of the Generic Design Assessment process

17 The objectives of the GDA process are that it:

- allows for demonstration that UK legal requirements are capable of being met by the design;
- is a staged approach with progress statements;
- facilitates the use of design standardisation;
- works within reasonable and predictable timescales;
- provides for public involvement;
- facilitates a rigorous NII assessment;
- is understandable and transparent; and
- has clear outcomes.

Objectives of this guidance document

18 The objectives of this guidance document are to provide Requesting Parties with:

- a defined content of safety submissions required;
- a clear definition of NII deliverables;
- indicative timescales for decisions; and
- information on the principles that NII will apply when judging the safety submissions.

HSE assessment

Legal duties

19 The GDA process will be undertaken within the existing UK nuclear regulatory framework, which is fully described in *The licensing of nuclear installations*.⁸ The main element of this is the Nuclear Installations Act 1965 (as amended), which sets down the requirement to obtain a nuclear site licence from HSE before installing a nuclear reactor on a site. It is underpinned by the more general Health and Safety at Work etc Act 1974, which places a fundamental responsibility on dutyholders to reduce risk 'so far as is reasonably practicable' (SFAIRP).

20 When assessing GDA submissions, HSE will also take into account other relevant UK health and safety legislation (as described in *The licensing of nuclear installations*⁸), including the Ionising Radiations Regulations 1999.⁹

ALARP

21 HSE's decision-making process is described in *Reducing risks, protecting people*.¹⁰ This includes an explanation of the concept of 'as low as reasonably practicable' (ALARP) and describes the legal requirement in the UK to demonstrate that risks are reduced SFAIRP, such that any further measures to reduce the risk would entail a gross disproportion between the sacrifice (time, trouble and money) and the risk averted by their adoption.

22 For HSE's assessment purposes the terms ALARP and SFAIRP are interchangeable and require the same tests to be applied. ALARP is also equivalent to the phrase 'as low as reasonably achievable' (ALARA) used by other bodies in radiation protection nationally and internationally.

23 The development of standards defining relevant good practice often includes ALARP considerations, so in many cases meeting these standards is sufficient to demonstrate that the legal requirement has been satisfied. In other cases, eg where standards and relevant good practice are less evident or not fully applicable or the demonstration of safety is complex, the onus will be on the Requesting Party to implement measures to the point where it can demonstrate to HSE's inspectors that the costs of any further measures would be grossly disproportionate to the risk averted.

24 While meeting good practice is a fundamental requirement for safety cases, this is expected to be supported by a demonstration of how risk assessments have been used to identify any potential weaknesses in the proposed facility design and operation, showing where improvements were considered and to demonstrate that safety is not unduly reliant on a small set of particular safety features. The application of ALARP should be carried out comprehensively and must show that any further risk reduction measures are grossly disproportionate to the risk averted.

25 Additional guidance on ALARP is given in HSE's Technical Assessment Guide (TAG) T/AST/005 *Demonstration of ALARP* (see list of TAGs in references).

26 In the particular case of new reactor design assessment, elements of what may be regarded as good practice and of what is reasonably practicable might be found in the design of reactors currently operating or under construction or licensing elsewhere in the world, including the Sizewell B design in the UK. However, other approaches to achieving the levels of safety embodied in aspects of these designs are also acceptable.

Safety Assessment Principles

27 During assessment, HSE inspectors are guided in their judgement by HSE's *Safety Assessment Principles for Nuclear Facilities (SAPs)*,¹¹ which set out relevant good practice for a wide range of nuclear facilities. To ensure consistency with international requirements, the SAPs have been benchmarked against IAEA's nuclear safety standards.

28 NII inspectors will use SAPs when reaching a judgement on the acceptability of the safety case for the proposed design. They are not criteria but an aid to judgement. Priority is given to achieving an overall balance of safety rather than satisfying each principle or making an ALARP judgement against each principle. The principles themselves are applied in a reasonably practicable manner and the judgement made is always subject to consideration of ALARP.

29 The SAPs also provide dutyholders and Requesting Parties with information on the regulatory principles against which their safety provisions will be assessed and judged by NII inspectors. However, the SAPs have been developed as guidance for assessing safety cases and as such they are not intended, nor are they sufficient, to be used as design or operational standards. Similarly, the SAPs are not sufficient to be used as an outline for, or as the determinant of the scope and depth of, any safety case developed by Requesting Parties.

30 The Requesting Party may choose to enhance their understanding of the basis for regulatory decision making by undertaking their own comparison of their design safety principles against the SAPs. This may allow the Requesting Parties to anticipate any issues or shortfalls and to include in their submissions explanation as to how the safety goals underlying the SAPs are met, or by providing evidence that equivalent safety is achieved by other means. It is NII's expectation that any comparison of a safety submission against the SAPs that a Requesting Party wishes to present should not form part of a safety submission itself, but would be a separate document. Where comparisons have been undertaken, these will be of interest to inspectors and may be requested.

31 Requesting Parties should note that not all SAPs are intended for use in nuclear power station assessments, nor are all the SAPs relevant for the GDA process. HSE inspectors will therefore use their judgement to assess against those SAPs that are relevant.

WENRA reference levels

32 Since the Western European Nuclear Regulators' Association (WENRA) reference levels¹² have been written to set European standards for existing nuclear reactors, new designs would be expected to be able to meet current WENRA reference levels for nuclear reactors easily.

Technical Assessment and Inspection Guides

33 For some time, HSE has been developing internal guidance for its inspectors in Technical Assessment Guides (TAGs) and Technical Inspection Guides (TIGs). These give detailed interpretation of the SAPs and guidance in their application. The SAPs and the TAGs are an integrated suite of guidance to HSE's nuclear

inspectors carrying out assessment of safety cases, whereas the TIGs are aimed at nuclear site inspectors carrying out licence condition compliance inspections. However, the GDA process will involve inspection of the Requesting Parties' processes, and some of these guides are therefore relevant, in particular those on duly authorised persons and suitably qualified and experienced persons; nuclear safety committees; and quality assurance (QA). There is currently a programme of review of TAGs, including updating them to be consistent with the latest issue of the SAPs and the WENRA reference levels. The TAGs are being updated to recognise WENRA reference levels as relevant good practice and to address any gaps with respect to WENRA reference levels. Most of the TAGs are published on HSE's website, except for a small number that are withheld for security reasons. The list of publicly available Technical Assessment Guides and relevant Technical Inspection Guides is given in 'References'.

Phase One: Generic Design Assessment

Requesting Party

34 In accordance with the BERR consultation document, requests for a Design Acceptance Confirmation will normally originate from a reactor vendor. However, this may also be done as a vendor/operator partnership. Consequently, the term 'Requesting Party' is used throughout this document to identify the organisation seeking the Design Acceptance and to distinguish it from a nuclear site licence applicant.

35 HSE expects that the GDA request will have support from an eventual UK site operator/licensee from the outset. Although the vendor has the detailed knowledge of the design, operator involvement will demonstrate that there is intent to transfer knowledge to the operator throughout the GDA process. Additionally, the operator may wish to vary the design to meet its particular needs.

Step 1: Design and safety case submission preparation

Step 1: Description and aims

Step 1 is the preparatory part of the design assessment process. The bulk of the work will be undertaken by the Requesting Party in assembling the safety submissions for Step 2. It also involves discussions between the Requesting Party and HSE to ensure a full understanding of the requirements and processes that will be applied and to arrive at formal agreements for cost recovery.

Step 1: The Requesting Party is required to:

- 1.1 Formally ask NII to perform a Generic Design Assessment of a proposed nuclear power station design.
- 1.2 Discuss with NII the proposed schedule for submission of safety documentation and the format of the documentation.
- 1.3 Enter into agreements with HSE as appropriate, covering:
 - (a) the scope of HSE assessment;
 - (b) project management arrangements and quality management system;
 - (c) the design change control process to be applied;
 - (d) timescales for responses to NII assessment questions/issues etc;
 - (e) arrangements for the public input process;
 - (f) arrangements for HSE to recover its costs;
 - (g) arrangements for ensuring that the designers and safety case producers are Suitably Qualified and Experienced Persons;
 - (h) the safety case developer's quality control, including peer review arrangements;
 - (i) a work programme and bespoke timetable for assessments (to be kept under review).
- 1.4 Ensure that NII will have full access to any proprietary commercial information necessary for it to complete its assessments at each step.
- 1.5 Prepare sufficient safety documentation to enable NII to undertake at least the Step 2 assessment.
- 1.6 Identify those elements of the safety submission that are commercially sensitive.
- 1.7 Undertake discussions with OCNS and classify their safety submission in accordance with security requirements, identifying sensitive nuclear information against OCNS guidance.
- 1.8 Publish their safety submission on their website (removing commercial and security sensitive information) to allow comments to be made by the public.

Step 1: HSE will:

- 1.9 Confirm that it has received the request for a Generic Design Assessment.
- 1.10 Agree with the Requesting Party the proposed schedule for submission of safety documentation and the format of the documentation and inform the Requesting Party of the implications of this for HSE's assessment programme.
- 1.11 Review the scope of the safety submissions for the Step 2 assessment and inform the Requesting Party:
 - if this is sufficient for HSE to begin Step 2 assessment; or
 - of the shortfalls in the documentation and any potential delay to Generic Design Assessment.

Step 1: HSE output

HSE will publish a statement that it has received a request to perform a Generic Design Assessment and is starting its Step 2 fundamental safety overview.

Step 2: Fundamental safety overview

Step 2: Description and aims

Step 2 is an overview of the fundamental acceptability of the proposed reactor design concept within the UK regulatory regime.

This step may take from 3–6 months, based on the assumption of assessing one design.

The aim of this step is to identify any fundamental design aspects or safety shortfalls that could prevent the proposed design from being licensed in the UK.

It will also introduce HSE inspectors to the fundamentals of the design and provide a basis for planning subsequent assessment.

Step 2: The Requesting Party is required to:

Provide a Preliminary Safety Report that includes sufficient information for the Step 2 fundamental safety overview, in particular:

- 2.1 A statement of the design philosophy and a description of the resultant conceptual design sufficient to allow identification of the main nuclear safety hazards, control measures and protection systems.
- 2.2 A description of the process being adopted by the applicant to demonstrate compliance with the UK legal duty to reduce risks to workers and the public SFAIRP.
- 2.3 Details of the safety principles and criteria that have been applied by the Requesting Party in its own assessment processes, including risks to workers and the public.
- 2.4 A broad demonstration that the principles and criteria are likely to be achieved.
- 2.5 An overview statement of the approach, scope, criteria and output of the deterministic safety analyses.
- 2.6 An overview statement of the approach, scope, criteria and output of the probabilistic safety analyses.
- 2.7 Specification of the site characteristics to be used as the basis for the safety analysis (the 'generic siting envelope').
- 2.8 Explicit references to standards and design codes used, justification of their applicability and a broad demonstration that they have been met (or exceptions justified).

- 2.9 Information on the quality management arrangements for the design, including design controls; control of standards; verification and validation; and the interface between design and safety.
- 2.10 A statement giving details of the safety case development process, including peer review arrangements, and how this gives assurance that nuclear risks are identified and managed.
- 2.11 Information on the quality management system for the safety case production.
- 2.12 Identification and explanation of any novel features,* including their importance to safety.
- 2.13 Identification and explanation of any deviations from modern international good practices.
- 2.14 Sufficient detail for NII to satisfy itself that SAPs and WENRA reference levels are likely to be satisfied.
- 2.15 Where appropriate, information about all the assessments completed by overseas regulators.
- 2.16 Identification of outstanding information that remains to be developed and its significance.
- 2.17 Information about any long-lead items that may be manufactured in parallel with the Generic Design Assessment process.
- 2.18 Information on radioactive waste management and decommissioning.

The Requesting Party will also be required to respond to questions and points of clarification raised by NII during its assessment, and to issues arising from public comments.

** In the context of GDA, the definition of a novel feature is any major system, structure or component not previously licensed in a nuclear power plant anywhere in the world.*

Step 2: HSE will:

Undertake an assessment directed at reviewing design concepts and claims. This will include:

- 2.19 The safety philosophy, standards and criteria used.
- 2.20 The approach to ALARP.
- 2.21 The Design Basis Analysis/fault study approach.
- 2.22 The probabilistic safety analysis (PSA) approach.
- 2.23 The overall safety case scope and extent.
- 2.24 An overview of the claims in a wide range of areas of the safety analysis.
- 2.25 The generic site envelope and its relevance to the safety case.
- 2.26 Any matters that might be in conflict with UK Government policy.
- 2.27 Any obstacles to Design Acceptance.
- 2.28 Outstanding issues raised through the public involvement process.

Step 2: HSE output

- A public statement from HSE on whether any fundamental safety issues had been identified that might prevent Design Acceptance in the UK or that have to be addressed to secure acceptance.
- A short report to support this statement.
- The relevant internal NII assessment reports will be published, along with any other reports relevant to Step 2.
- Confirmation that the design can move to Step 3.

[The judgement on acceptance in principle will be subject to the proposed design concept and Requesting Party's design criteria being realised in practice through the detailed design.]

Step 3: Overall design safety review

Step 3: Description and aims

Step 3 is an NII review of the safety aspects of the proposed reactor design.

This step may take from 6–12 months, based on the assumption of assessing one design.

The general intention will be to move from the fundamentals of the previous step to an analysis of the design, primarily by examination at the system level and by analysis of the Requesting Party's supporting arguments.

The specific aims of this step are to:

- improve HSE knowledge of the design;
- identify significant issues;
- identify whether any significant design or safety case changes may be needed;
- identify major issues that may affect design acceptance and attempt to resolve them;
- achieve a significant reduction in regulatory uncertainty.

The exact scope and focus will depend on the design and on the outcome of Step 2.

Step 3: The Requesting Party is required to:

Provide a detailed Pre-Construction Safety Report that includes the following:

- 3.1 Definition of the documentary scope and extent of the safety case.
- 3.2 Explanation of how the decisions regarding the achievement of safety functions ensure that the overall risk to workers and public will be ALARP.
- 3.3 Responses to any issues outstanding from Step 2.
- 3.4 Sufficient information to substantiate the claims made in Step 2 (in the Preliminary Safety Report).
- 3.5 Sufficient information to enable NII to assess the design against all relevant SAPs.
- 3.6 A demonstration that the detailed design proposal will meet the safety objectives before construction or installation commences, and that sufficient analysis and engineering substantiation has been performed to prove that the plant will be safe.
- 3.7 Detailed descriptions of system architectures, their safety functions and reliability and availability requirements.
- 3.8 Confirmation and justification of the design codes and standards that have been used and where they have been applied, non-compliances and their justification.

- 3.9 Fault analyses including Design Basis Analysis, Severe Accident Analysis and PSA.
- 3.10 Justification of the safety of the design throughout the plant's life cycle, from construction through operation to decommissioning, and including on-site spent fuel and radioactive waste management issues.
- 3.11 Identification of potentially significant safety issues raised during previous assessments of the design by overseas nuclear safety regulators, and explanations of how their resolution has been or is to be achieved.
- 3.12 Identification of the safe operating envelope and the operating regime that maintains the integrity of the envelope.
- 3.13 Confirmation of:
 - (a) which aspects of the design and its supporting documentation are complete and are to be covered by the Design Acceptance Confirmation;
 - (b) which aspects are still under development and identification of outstanding confirmatory work that will be addressed during Step 4.

Where necessary, the Requesting Party should update their safety case on their website (removing commercial information, and security sensitive information) to reflect the above additional details, and to allow comments to be made by the public.

The Requesting Party will also be required to respond to questions and points of clarification raised by NII during its assessment, and to issues arising from public comments.

Step 3: HSE will:

Undertake an assessment, on a sampling basis, primarily directed at the system level and by analysis of the Requesting Party's supporting arguments. The scope will be partly defined by experience in Step 2 and the issues arising in that step. This will include:

- 3.14 Consideration of whether the design is likely to meet the Requesting Party's design safety criteria and reduce risks ALARP.
- 3.15 Undertaking an initial assessment of the scope and extent of the arguments in each of the technical areas, including the generic site envelope.
- 3.16 Assessing the safety case development process scope and extent.
- 3.17 Reviewing what overseas regulators have done and how HSE can make use of it.
- 3.18 Deciding on scope and plan of further assessment.
- 3.19 Assessment of the quality assurance (QA) arrangements, including:
 - (a) QA arrangements for the early manufacture of long lead time items important to safety;
 - (b) safety case and design change control arrangements.
- 3.20 Identification of research needs and setting up of longer-term research or contract support to complement Step 4.
- 3.21 Assessment of the Requesting Party's independent verification.
- 3.22 Identification of needs for additional regulatory verification/analysis.
- 3.23 Judging whether the overall design is balanced in terms of the different contributors to overall risk from the plant.
- 3.24 A review of the proposals for spent fuel, radioactive waste management and decommissioning.
- 3.25 Issues raised through the public involvement process.
- 3.26 Providing advice to the Environment Agency to support their public consultation process.

Step 3: HSE output

- A public HSE statement on the adequacy of the assessed safety features of the design, including safety issues with the potential to lead to significant design or safety case changes, or to prevent successful Design Acceptance.
- A report to support this statement.
- The relevant internal NII assessment reports will be published, along with any other reports relevant to Step 3.
- Confirmation that the design can move to Step 4.

[The judgement to accept system design and safety arguments at Step 3 would be subject to system performance and reliability requirements being shown to be met in practice through the detail design, and to the ongoing resolution of any outstanding issues on the statement in Step 4.]

Step 4: Detailed design assessment

Step 4: Description and aims

Step 4 is an in-depth NII assessment of the safety case and generic site envelope submitted.

This step may take about two years, based on the assumption of assessing one design.

The general intention of this step is to move from the system level assessment of Step 3 to a fully detailed examination of the evidence, on a sampling basis, given by the safety analyses.

The aim of this step is:

- to confirm that the higher level claims such as system functionality are properly justified;
- to complete sufficient detailed assessment to allow NII to come to a judgment whether a Design Acceptance Confirmation can be issued.

The exact scope and focus will depend on the design and on the outcome of Step 3.

Step 4: The Requesting Party is required to:

Provide any outstanding information, safety case material and research results that support the submission and, in addition, to submit:

- 4.1 A demonstration that construction and installation activities will result in a plant of appropriate quality.
- 4.2 A demonstration that the constructed plant will be capable of being operated within safe limits.
- 4.3 Arrangements for moving the safety case to an operating regime; ie the arrangements to ensure that the requirements of, and assumptions in, the safety case will be captured in:
 - (a) technical specifications;
 - (b) maintenance schedule;
 - (c) procedures (normal operation, emergency, accident management);
 - (d) training programmes;
 - (e) emergency preparedness;
 - (f) operating limits;
 - (g) radiation protection arrangements for operators;

- (h) lifetime records;
- (i) commissioning requirements etc.

- 4.4 Arrangements for design and safety case definition and freeze.
- 4.5 Arrangements for putting in place a Design Authority.
- 4.6 Arrangements that demonstrate that any site-specific changes against the generic design will be managed within an agreed change control process.
- 4.7 Responses to any issues outstanding from Step 3.

The Requesting Party will also be required to respond to questions and points of clarification raised by NII during its assessment, and to issues arising from public comments.

Step 4: HSE will:

Undertake a detailed assessment on a sampling basis. This will involve identifying and completing an assessment plan, which will include:

- 4.8 Consideration of issues identified in Step 3.
- 4.9 Judging the design against SAPs and judging whether the proposed design reduces risks ALARP.
- 4.10 Inspections of the Requesting Party's procedures and records.
- 4.11 Independent verification analyses.
- 4.12 Reviewing details of the design controls, procurement and quality control arrangements to secure compliance with the design intent.
- 4.13 Establishing whether the system performance and reliability requirements are substantiated by the detailed engineering design.
- 4.14 Assessing arrangements for moving the safety case to an operating regime.
- 4.15 Assessing arrangements for ensuring and assuring that safety claims and assumptions are realised in the final design, building and construction.
- 4.16 Judging whether significant site parameters are appropriately defined in the generic site envelope.
- 4.17 Reviewing overseas progress and issues raised by overseas regulators.
- 4.18 Considering unresolved issues raised through the public involvement process.
- 4.19 Resolution of identified nuclear safety issues, or identifying paths for resolution.

Step 4: HSE output

- A public HSE statement providing a Design Acceptance Confirmation (if the design is judged to be acceptable).
- A report to support this statement.
- The relevant internal NII assessment reports will be published, along with any other reports relevant to Step 4.

[Design Acceptance Confirmation will mean that this station design will be suitable for construction, as far as HSE nuclear safety assessment is concerned, once a licence is granted, on any UK site demonstrated to be within the generic siting envelope, subject to any exclusions that HSE may choose to apply.]

Supporting information for HSE’s Generic Design Assessment process

Additional information on expected safety submissions

36 The 2006 edition of SAPs includes a new section on the regulatory assessment of safety cases. HSE Technical Assessment Guide on the purpose, scope and content of nuclear safety cases (T/AST/051 – see list of TAGs in references) gives the principal stages of the safety cases associated with the nuclear plant life cycle. Table 2 below shows how these relate to the GDA process.

Table 2 Safety reports identified in T/AST/051

Report	Input to
Preliminary Safety Report	Fundamental safety overview in Phase One Step 2
Generic Pre-Construction Safety Report (PCSR)	Assessment in Phase One Steps 3 and 4
Site-specific Pre-Construction Safety Report	Phase Two Licensing assessment
Pre-Commissioning Safety Report	Prior to (inactive and active) commissioning
Pre-Operational Safety Report	Prior to reactor operation

37 If the Requesting Party desires, it may submit the generic PCSR along with the Preliminary Safety Report during Step 1 of the GDA process.

Use of documentation not specific to UK

38 HSE recognises that the Requesting Party may choose to use existing design and safety documents that were not written explicitly for the UK. While this may be efficient for the Requesting Party in providing documentation, it would not on its own be sufficient for assessment by the UK regulator. HSE would need to receive some additional UK-specific submissions that demonstrate how UK requirements have been met or will be met.

39 HSE requires that documents submitted are written in English and that SI units are used.

Openness, transparency and public input

40 HSE is seeking to introduce high standards of openness and transparency to the GDA process. Arrangements will be agreed between HSE and the Requesting Parties to enable the public to view the safety cases provided by the Requesting Parties on the Internet, excepting commercially confidential and security sensitive information. An opportunity will then be given for the public to comment to Requesting Parties on that information, who will be asked to respond to the issues raised.

41 The Regulators will oversee this process, which will be administered by the Joint Programme Office. At key stages in the process they will publish their views on the main issues raised and responded to in the public involvement process. They will also publish all their assessment reports and a range of other documentation associated with the GDA process, as part of moves towards greater transparency.

42 Throughout the Generic Design Assessment process, the Regulators will remain responsible for all decisions made on the acceptability or otherwise of the power station designs put forward by each Requesting Party. Thus, while the issues raised and the Requesting Party's responses will be given due consideration and the decision-making process will be made as transparent as possible, all regulatory decisions will remain vested in the Regulators.

Fault analysis and PSA

43 Fault analysis should be carried out comprising design basis analysis, suitable and sufficient PSA, and suitable and sufficient severe accident analysis.

44 HSE expects that the submission for design acceptance should include a full scope Level 1 and Level 2 PSA. The PSA should be used to help show that the design satisfies the ALARP requirement. A Level 3 PSA relevant to the generic site will also be expected in Phase One.

45 HSE does not prescribe numerical requirements. Where numerical targets are given in the SAPs, HSE will seek sufficient information for it to be able to judge that the target is likely to be achieved and the overall risk is ALARP. Further guidance on HSE expectations relevant to PSA and to fault analysis can be found in the SAPs and in the TAGs on accident analysis (see references).

Life cycle – construction to decommissioning and spent fuel management

46 HSE will take a holistic approach to assessing proposals for new build. Therefore the safety submission should cover all through-life aspects including design, construction, maintenance, operation, spent fuel and radioactive waste management and decommissioning. The depth of the information required may vary according to the significance of each issue to the GDA.

47 Requesting Parties should identify the management arrangements for the spent fuel and radioactive waste arisings from operation of the reactors for their projected life. This should include:

- the strategies for decommissioning, and management of spent fuel, all radioactive wastes and substances that might become wastes;
- the safe storage of radioactive wastes pending disposal;
- the disposability of wastes; and
- a demonstration of how the design and its proposed operation will avoid or minimise the generation of radioactive waste.

48 Responsibility for policy on radioactive waste and decommissioning is shared between a number of government departments and the devolved administrations. In recognition of the disparate nature of the sources of published policy a rolling summary is available¹³ which attempts to summarise the existing policy for radioactive waste and decommissioning.

49 The UK Government has recently set out its framework for managing higher-activity wastes through geological disposal in *Managing Radioactive Waste Safely*.¹⁴ This process is based on the current UK radioactive waste inventory¹⁵ but it is intended to be able to accommodate waste and spent fuel arising from any new build programme. Requesting Parties will be expected to seek assurance that the expected waste streams will be acceptable for disposal in such a facility: the Nuclear Decommissioning Authority (NDA) has published a protocol to facilitate the necessary assessments, *Disposability Assessment of Solid Waste Arisings from New Build*.¹⁶

Generic site characteristics

50 The Requesting Party will need to specify generic siting characteristics for a range of UK sites against which HSE could assess the acceptability of the design safety case. These characteristics, such as the density and distribution of the assumed local population, seismic hazard, extreme weather events and other external hazards, should, so far as possible, envelop or bound the characteristics of any potential UK site so that reactors of this type could potentially be built at a number of suitable locations.

51 Guidance on HSE's expectations on generic site characterisation is contained in the Appendix.

52 For the Phase Two site licensing assessment, a licence applicant would need to demonstrate that its chosen site fell within the generic siting envelope, to ensure that the Generic Design Assessment can be taken fully into account during licence applications.

Safety management

53 The GDA process requires Requesting Parties to provide information on the quality management arrangements for the design and safety case production.

54 In addition, the design authority role should be described in Step 4. For guidance on design authority aspects, see *Maintaining the design integrity of nuclear installations throughout their operating life*.¹⁷

55 If key safety-related plant has already been or is in the process of being manufactured, the Requesting Party should specify what quality management arrangements have been or will be used during all stages of the manufacturing process.

56 Safety management requirements for the Phase Two licensing process are more onerous (see section below on the Phase Two assessment).

57 Existing guidance on some aspects of HSE's assessment of the design process, design authority, change control, design quality assurance and intelligent customer capability is given in HSE's Technical Assessment Guide T/AST/057 *Design safety assurance* (see list of TAGs in references).

Processes for development of the safety case

58 The process used to produce safety cases needs to deliver consistently good-quality, fit-for-purpose cases. For a safety case to claim that the plant under consideration is very reliable or highly unlikely to fail, the process used to derive

such claims needs to have commensurate reliability. The Requesting Party will therefore need to demonstrate that the process that has been used in the safety case production has included, for example, appropriate verification controls, a formal approval procedure, and an independent review, the rigour of which should be demonstrated to be consistent with the safety importance of the subject matter.

59 In view of this, NII's assessment may involve inspection of an organisation's processes as well as assessment of the safety cases themselves. Further information on NII's expectations regarding safety case due process is given in the revised SAPs, and in TAG T/AST/051 (see the list of TAGs in the references).

Generic Design Assessment reporting by HSE after each step

60 On completion of each of the GDA steps, NII will come to a decision on the acceptability of the Requesting Party's submission, make a public statement, and publish a report to support the decision and any relevant reports deemed appropriate. This report will summarise the assessments undertaken and reasons why HSE's decision was reached. If a submission is unsuccessful, HSE will identify the safety issues that are regarded as either unacceptable or requiring further elaboration. HSE's judgements and public statements may be deferred if the Requesting Party wishes to make further information available for HSE to take into account before reaching a decision. In this event, HSE may make a public statement explaining that this was the reason for the delay. The GDA reports may include outstanding issues or requirements for subsequent phases/steps but HSE will seek to minimise any such requirements.

Design Acceptance Confirmation

61 At the end of Step 4, the output from the detailed Generic Design Assessment will be a public statement from HSE providing a Design Acceptance Confirmation (if successful). The accepted design should then be suitable for construction, as far as HSE nuclear safety assessment is concerned, subject to a site-specific licence being granted, on any UK site demonstrated to be within the generic siting envelope. Construction could not of course proceed until after a site licence had been granted.

62 If HSE's assessment of the design is generally positive but some nuclear safety issues remain, or where there are other exclusions deemed necessary by HSE, these will be identified at the time the Design Acceptance Confirmation is issued. These will need to be addressed during the nuclear site licensing process before a licence can be issued. It is intended that any such requirements will be minimised.

Period of validity

63 Any Design Acceptance Confirmation issued would apply for that generic design for a period of ten years. This would be subject to no significant new information arising during that period which might call into question the basis of HSE's original assessment of the design. This period of validity is based upon the existing HSE requirement for licensees to undertake periodic safety reviews of their existing nuclear facilities every ten years.

64 HSE assessment during the subsequent nuclear site licensing stages will include consideration of the significance of any related safety developments so that the commencement of the ten-year periodic safety review period can be agreed with the licensee.

65 If a Requesting Party wishes to seek renewal of a Design Acceptance Confirmation at the end of this ten-year period, HSE will require them to review the safety case in the manner of a periodic safety review and report to HSE. It is envisaged that Design Acceptance renewal would be much less resource intensive than the original assessment, but some design improvements might be needed to gain renewal if these were found to be reasonably practicable at that time, eg in the light of emerging international practices.

Taking account of overseas regulator assessments

66 Where a reactor design has been subject to assessment by overseas nuclear regulators, HSE sees great value in being able to share information with them. This is in fact an extension of the normal information exchanges that take place between international nuclear regulators through organisations such as IAEA, the International Nuclear Regulators Association (INRA), the Organisation for Economic Co-operation and Development Nuclear Energy Agency (OECD-NEA) and the Committee for Nuclear Regulatory Activities (CNRA). In addition, HSE is participating in the work of the newly formed Multinational Design Evaluation Program (MDEP).

67 Throughout the GDA process HSE will seek to take advantage of assessments of the proposed design undertaken previously by overseas nuclear safety regulators. For example, where detailed independent analyses of nuclear safety issues or validation of computer codes are available, HSE will seek to make use of them. HSE assesses on a sampling basis and therefore the availability of additional information will help target resources to best effect. HSE's attention could then, for example, be concentrated on UK-specific areas.

68 However, it should be noted that it is the responsibility of the Requesting Party to demonstrate the safety of its proposed reactor designs, including highlighting and directing HSE to previous outputs and assessments made by overseas regulators, not for HSE to assemble information on regulatory issues resolved overseas and in effect make the case on the Requesting Party's behalf.

69 IAEA guidance states that even if a similar design has been authorised in another State, the regulatory body should still perform its own independent review and assessment (*Review and Assessment of Nuclear Facilities by the Regulatory Body*¹⁸ paragraph 3.37). Similarly, the UK has signed the Convention on Nuclear Safety, which states that each country must undertake safety assessment of its own nuclear facilities and make its own regulatory decisions about the safety of those facilities. HSE will therefore be undertaking its own assessment and coming to its own judgements. HSE will not necessarily accept that a regulatory issue of concern to it has been resolved simply because an overseas regulator has considered the same issue and agreed its resolution. HSE may, as it considers necessary, test the robustness of such claims. HSE's position on this international context is given in *New nuclear power stations: Safety assessment in an international context*.¹⁹

70 The extent to which overseas assessments can be taken into account will depend on a number of factors including:

- the date of the assessment and its continuing validity;
- the level of detail and the purpose of the assessment;
- the local conditions of use relating to the assessment;
- the depth of information provided by the Requesting Party including the evidence of issue resolution;

- whether overseas assumptions (eg on plant operating regime) will remain valid if the technology is adopted in the UK;
- whether a demonstration can be made satisfying the legal requirement that the risks have been reduced to a level that is ALARP;
- the scope of HSE's formal information exchange agreements with the overseas regulator;
- the overseas regulatory system and HSE's knowledge of it;
- the willingness of the overseas regulator to engage with HSE on issues of primary interest to the UK, including providing access to detailed information.

International guidance

71 As they prepare their submissions, Requesting Parties may wish to take account of the requirements of IAEA safety standards and guides. HSE's SAPs have been benchmarked against these standards to ensure that HSE requirements fully reflect international nuclear safety standards.

Utilities Requirements Documents

72 Although the design may have been against a Utilities Requirements Document (eg US or European), HSE regards these as being for the designers, not for the regulator. HSE will not endorse the utilities' standards or use them for its own assessment purposes. HSE will assess the safety of the design using its own SAPs.

Regulatory uncertainty

73 The processes given here are intended to give a predictable process and a more certain timescale, but the outcome depends on a number of factors which are out of HSE's control, including the quality of the Requesting Party's submission. An indicative assessment timetable is given in Table 1. By allowing the completion of elements of the design safety assessment process before major investment in site selection, equipment ordering, manufacture and construction, the GDA process provides a mechanism for reducing regulatory uncertainty for the Requesting Party and the potential licence applicant, while maintaining the rigour of HSE's regulatory assessment. The process is also designed to promote increased public involvement and enhance confidence, both in the regulatory process itself and, ultimately, in any decisions regarding the safety of the proposed design.

74 To help provide certainty in the regulatory processes, HSE will establish agreements with the Requesting Party setting out in detail what it expects from the Requesting Party, as well as the scope of the assessment etc. The arrangements will also set down what may be expected of HSE and how the working interface between the Requesting Party and HSE will be organised. These detailed arrangements are set out in an Interface Protocol, as described in the section 'Project management and administration'. HSE intends to engage with Requesting Parties throughout the assessment process, and will provide progress statements. HSE will require that the Requesting Party responds to assessment questions within an agreed timeframe.

75 While HSE believes that the new process offers the potential for a stepwise reduction in regulatory uncertainty, it cannot completely eliminate the possibility that design change requests may be necessitated at later stages of assessment.

Safety case ownership

76 The emphasis in UK health and safety regulation is that the end product of the safety analysis, ie the final suite of safety documentation, is owned by the licensee, who has the ultimate legal responsibility for ensuring the safety of the plant. The safety case must therefore be produced with the operator in mind, not as a means to satisfy the regulator. In the Generic Design Assessment phase, HSE will expect that the safety case is fit for use by a site operator, and in Phase Two – site licensing – HSE will assess the degree of ownership of the safety case by the prospective site licensee.

Age of design

77 If the original reactor design was frozen or 'fixed' some time ago, evidence should be provided by the Requesting Party that adequate consideration has been given to:

- developments in nuclear technology since the design was frozen;
- operating experience in similar plants elsewhere;
- relevant new research findings; and
- any other factors arising that may have an impact on safety of the design.

These will be taken into account in HSE's regulatory assessment.

Design variants

78 HSE cannot prohibit the operators from proposing variants of the same basic design, but preferably this should be avoided for reasons of standardisation. HSE considers that ALARP considerations are likely to lead to a high degree of standardisation for a series of reactors.

Research and technical support

79 HSE's expectation is that adequate research and technical support will have been completed by the Requesting Party. Factors affecting research requirements include:

- departure from proven technology;
- uncertainties in performance; and
- degree of defence-in-depth.

80 HSE may carry out additional confirmatory research or technical analyses to support its regulatory decisions and it may also engage external contractors, including non-UK organisations. The costs of such research will be charged to the Requesting Party. Factors affecting such research requirements include:

- familiarity of the technology to the UK;
- issues arising from early steps of the safety case assessment;
- other research and development programmes, including research information from other overseas regulators who have reviewed the design.

Phase Two: Nuclear site licensing

81 Phase Two of the new nuclear power station licensing process is HSE's assessment of a site-specific and organisation-specific application for a nuclear site licence. This requires assessment of the site-specific plant (taking account of the assessments undertaken throughout Generic Design Assessment), the specific site, and the operating organisation which will become the licence holder. It is expected that if the applicant provides detailed and adequate submissions, HSE's Phase Two assessment would take around 6–12 months. Guidance on applying for a nuclear site licence is given in *Applying for a nuclear site licence for new nuclear power stations: A step-by-step guide*.²⁰ Potential site licence applicants are encouraged to contact NII early to discuss the process.

82 The design assessment could be a simple process referencing Design Acceptance Confirmation. In addition:

- any site-specific aspects not covered by the generic site envelope will have to be assessed;
- any exclusions in the Design Acceptance Confirmation will have to be assessed (see *Review and Assessment of Nuclear Facilities by the Regulatory Body*¹⁸); and
- any proposed changes to the design would also need reassessment on a case-by-case basis within a formal design change control system.

83 There needs to be a design authority, and a process for transfer of knowledge from the designer to the operator. For guidance on design authority aspects, see *Maintaining the design integrity of nuclear installations throughout their operating life*.¹⁷

Transfer of knowledge from vendor to licensee

84 The nuclear site licence requires that the licensee is fully in control of activities on its site, understands the hazards of its activities and how to control them, and is an intelligent customer for any work it commissions externally. This requires the licensee to have suitably qualified, and experienced staff undertaking all activities that could affect safety on the site. For most potential reactor designs the expert knowledge will initially rest with the vendor and without appropriate strategies to transfer knowledge and information to potential operators/site licensees, this could complicate nuclear site licensing. Therefore, the GDA process should allow the prospective licensee sufficient time to build up qualified and experienced staff and transfer knowledge to them from the vendor organisation.

85 HSE will expect this transfer of knowledge to be well advanced by the time the applicant makes the nuclear site licence application (ie by the start of Phase Two), and the licence applicant must be able to demonstrate that it is ready to take control of all activities on the site before the licence is granted.

Relationship of Generic Design Assessment and nuclear site licensing

86 The GDA process is not mandatory. Direct licence applications may be made, but HSE expects the GDA process to be followed by most applicants as this is likely to be a more efficient process.

Review of decision

87 Where a Requesting Party is dissatisfied with a decision by HSE and remains dissatisfied following representations to the appropriate inspector and their line management in HSE, the ultimate arbiter of the decision is HM Chief Inspector of Nuclear Installations. However, the Requesting Party may seek a review by HSE of the process by which the decision has been reached.

Project management and administration

88 There is co-ordination of the processes between the different regulators (HSE, the Environment Agency and also the Department for Transport), which is described in a regulatory top-tier guidance document *New nuclear power stations Generic Design Assessment: A guide to the regulatory process*.¹ To help administer the GDA process, a Joint Programme Office has been set up to provide a single point of contact between the Requesting Party and nuclear regulators. The Joint Programme Office will represent HSE (including NII and OCNS) and the Environment Agency.

HSE–Requesting Party interface arrangements

89 There is an Interface Protocol which sets out the working arrangements for interfaces between HSE, the Environment Agency and the Requesting Party. This sets out an agreed system for correspondence, meetings and issue tracking, and will be agreed with the Requesting Party in Step 1.

Recovery of HSE costs

90 The Requesting Party will pay all HSE costs in connection with the Generic Design Assessment. For Phase One Generic Design Assessment, HSE will use Fees Regulations made under section 43 of the Health and Safety at Work etc Act 1974 as the basis for recovering its costs. The detailed arrangements for cost recovery will be agreed with the Requesting Party at the beginning of Step 1.

Appendix The generic site envelope

- 1 Although much of a power station design will be independent of the location chosen for its construction, some assumptions about the characteristics of the plant's environment must be considered in developing the design of certain safety-related features. HSE expects that designs submitted for Generic Design Assessment will have been designed to be suitable for being built on a variety of sites within the UK. To this end, HSE will expect the Requesting Party to specify the 'site envelope' within which the plant is designed to operate safely. The definition of the site envelope can be as broad or narrow as the applicant wishes. However, it should be unambiguous and specify any site-related characteristics which have been explicitly included within or excluded from that definition.
- 2 If a subsequent site licence application is made for a site in the UK which has characteristics bounded by the generic site envelope then the time taken for HSE's licensing assessment will be minimised. If the proposed site has characteristics which lie outside the generic site envelope, the applicant will need to demonstrate by some other means that the proposed plant is acceptable at the proposed site. This may involve additional safety analysis and/or plant redesign.
- 3 This note provides a brief overview of HSE's expectations for a generic site envelope.

Heat sink

- 4 The type and capacity of potential heat sinks should be specified.

Grid connections

- 5 Assumptions about the type and reliability of grid connections should be identified.

Density and distribution of local population

- 6 When considering the generic site envelope, account should be taken of factors that might affect the protection of individuals and populations from radiological risk. Key factors here include assumptions about the local population distribution and density, and the provision for effective emergency preparedness and accident management.
- 7 Assumptions regarding the density and distribution of the local population should also take account of existing UK government siting policies. The current government policy on nuclear siting criteria is stated in pages 116–117 in the section on Article 17 (Siting) of the UK's Third National Report (2004) on compliance with the obligations of the Convention on Nuclear Safety.²¹ The updates to the demographic siting policy will be undertaken as part of the Strategic Siting Assessment consultation (see *The Future of Nuclear Power: The role of nuclear power in a low carbon UK economy*⁶).

External hazards

- 8 External hazards that could affect the safety of the facility should be identified and treated as events that can give rise to possible initiating faults. The Requesting Party should demonstrate that an effective process has been applied to identify typical external hazards and potential environmental changes such as climate

change (eg a change in sea level) which may affect sites in the UK. Any foreseeable variations in these factors during the expected lifetime of the site should be identified and taken into account. Further guidance is available in HSE's Safety Assessment Principles.

9 The following external hazards may influence the plant design. The generic site envelope should encompass a range of external hazards for sites typical of the UK. The sensitivity of the design to the magnitude of external hazards should be well understood. This will be particularly important at the site-specific application stage, where a rigorous comparison of the generic site envelope against site-specific criteria will be undertaken.

(i) Seismotectonic:

- earthquakes:
 - long period ground motion;
 - liquefaction.

(ii) Flooding:

- extreme rainfall;
- tidal effects/storm surge/seiche/tsunami;
- watercourse containment failure.

(iii) Meteorological:

- weather effects:
 - high wind (tornado, hurricane, cyclone) and wind-blown debris;
 - extreme drought;
 - extremes of air and ground temperature;
 - extremes of sea (or river) temperature;
 - lightning;
 - extreme hail, sleet or snow and icing;
 - humidity;
- climate change (affects many of the above).

(iv) Man made:

- accidental aircraft impact;
- impacts from adjacent sites:
 - gas clouds (toxic, asphyxiating, flammable);
 - liquid releases (flammable, toxic, radioactive);
 - fires/explosions (blast waves, missiles);
 - missiles (turbines, bottles, boiling liquid expanding vapour explosion);
 - transport accidents (road, sea, rail);
 - electromagnetic interference;
 - pipelines (gas, oil, water);
 - industrial vibrations;
- malicious activity.

(v) Biological

- biological fouling:
 - seaweed;
 - fish/jellyfish/marine growth;
- animal infestation (eg rodents);
- insect swarms.

(v) Geological

- ground movement, eg due to:
 - settlement/heave;
 - subterranean collapse (mining/caverns);
- groundwater intrusion/leeching;

- existing industrially contaminated land;
- landslides;
- radon seepage and accumulation;
- geological fissures/faults;
- landscape changes caused by natural geological and metamorphic processes.

The task of defining worst-case malicious activity scenarios is the responsibility of OCNS, which has sole responsibility for establishing and documenting the design-basis threat (DBT). The DBT defines a range of threats that could be faced by civil nuclear facilities. The Requesting Party should discuss with NII and OCNS how the plant will be designed and operated to address the DBT.

Abbreviations

ALARA	as low as reasonably achievable
ALARP	as low as reasonably practicable
BERR	Department for Business, Enterprise and Regulatory Reform
CNRA	Committee for Nuclear Regulatory Activities
GDA	Generic Design Assessment
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
INRA	International Nuclear Regulators Association
INSAG	International Nuclear Safety Advisory Group
IRRS	International Regulatory Review Service
MDEP	Multinational Design Evaluation Program
NDA	Nuclear Decommissioning Authority
NII	(Her Majesty's) Nuclear Installations Inspectorate
OCNS	Office for Civil Nuclear Security
OECD-NEA	Organisation for Economic Co-operation and Development Nuclear Energy Agency
PCSR	Pre-Construction Safety Report
PSA	Probabilistic Safety Analysis
QA	quality assurance
SAP	Safety Assessment Principle
SFAIRP	so far as is reasonably practicable
TAG	Technical Assessment Guide
TIG	Technical Inspection Guide
WENRA	Western European Nuclear Regulators' Association

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- 6 *The Future of Nuclear Power: The role of nuclear power in a low carbon UK economy* Consultation Document DTI May 2007
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HSE Technical Assessment Guides

Technical Assessment Guides (TAGs) are published on HSE's website
www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/index.htm.

Other TAGs may be available. The TAGs were written referring to the 1992 SAPs. A cross-reference table relating the 1992 SAPs to the 2006 SAPs is available at www.hse.gov.uk/nuclear/saps/crossreference.pdf.

Information on the TAGs revision programme is given at www.hse.gov.uk/nuclear/tagstables.htm.

T/AST/FWD Purpose and scope of the guide

AST/001 Assessment process
AST/002 Assessment activity management
AST/003 Assessment reporting
G/AST/001 Guidance: Assessment process

Safety case structure and assessment

T/AST/035 The limits and conditions for nuclear plant safety
T/AST/050 Periodic safety reviews (PSRs)
T/AST/051 Guidance on the purpose, scope and content of nuclear safety cases

Radiological protection

T/AST/002 Shielding
T/AST/004 Fundamental principles
T/AST/038 Radiological protection
T/AST/041 Control, storage, handling and transport of nuclear matter including fissile materials

Electrical engineering and control and instrumentation

T/AST/003 Safety systems
T/AST/008 Safety categorisation and equipment qualification
T/AST/015 Electromagnetic compatibility
T/AST/019 Containment: Essential services
T/AST/028 Control and instrumentation aspects of nuclear plant commissioning
T/AST/046 Computer based safety systems

Accident analysis

T/AST/006 Deterministic safety analysis and the use of engineering principles in safety assessment
T/AST/011 The single failure criterion
T/AST/030 Probabilistic safety analysis (revised version under preparation)
T/AST/034 Transient analysis for DBAs in nuclear reactors
T/AST/037 Heat transporter systems
T/AST/042 Containment: Validation of computer codes and calculational methods
T/AST/044 Fault analysis

ALARP

T/AST/005 Demonstration of ALARP

Organisational, human factors and QA

T/AST/010 Operator action and the '30 minute rule'
T/AST/027 Assessment of licensees' arrangements for training and competence assessment
T/AST/033 Record storage
T/AST/039 Management for safety
T/AST/048 Licence Condition 36 arrangements
T/AST/049 Principles for the assessment of a licensee's 'intelligent customer capability'
T/AST/052 Contractorisation

Chemistry, chemical engineering and internal hazards

T/AST/014 Internal hazards
T/AST/023 Control of processes involving nuclear matter

Civil engineering and external hazards

T/AST/013 External hazards
T/AST/017 Structural integrity: Civil engineering aspects
T/AST/020 Containment for reactor plant

Structural integrity

T/AST/016 Structural integrity

Graphite behaviour

T/AST/029 Graphite reactor cores

Mechanical engineering

T/AST/009 Maintenance, inspection and testing of safety systems, safety related structures and components

T/AST/021 Containment: Chemical plants

T/AST/022 Ventilation

T/AST/036 Diversity, redundancy, segregation and layout of mechanical plant

T/AST/056 Nuclear lifting operations

T/AST/057 Design safety assurance

Radioactive waste and decommissioning

T/AST/024 Management of radioactive materials and radioactive waste on nuclear licensed sites

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