

IAEA Safety Standards

for protecting people and the environment

Site Survey and Site Selection for Nuclear Installations

Specific Safety Guide

No. SSG-35



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IAEA SAFETY STANDARDS

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The publications by means of which the IAEA establishes standards are issued in the **IAEA Safety Standards Series**. This series covers nuclear safety, radiation safety, transport safety and waste safety. The publication categories in the series are **Safety Fundamentals**, **Safety Requirements** and **Safety Guides**.

Information on the IAEA's safety standards programme is available on the IAEA Internet site

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The site provides the texts in English of published and draft safety standards. The texts of safety standards issued in Arabic, Chinese, French, Russian and Spanish, the IAEA Safety Glossary and a status report for safety standards under development are also available. For further information, please contact the IAEA at: Vienna International Centre, PO Box 100, 1400 Vienna, Austria.

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SITE SURVEY AND
SITE SELECTION FOR
NUCLEAR INSTALLATIONS



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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

IAEA SAFETY STANDARDS SERIES No. SSG-35

SITE SURVEY AND SITE SELECTION FOR NUCLEAR INSTALLATIONS

SPECIFIC SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2015

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tel.: +43 1 2600 22417
email: sales.publications@iaea.org
<http://www.iaea.org/books>

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Printed by the IAEA in Austria
July 2015
STI/PUB/1690

IAEA Library Cataloguing in Publication Data

Site survey and site selection for nuclear installations. — Vienna : International Atomic Energy Agency, 2015.

p. ; 24 cm. — (IAEA safety standards series, ISSN 1020-525X ; no. SSG-35)

STI/PUB/1690

ISBN 978-92-0-102415-2

Includes bibliographical references.

1. Nuclear facilities — Location. 2. Nuclear power plants — Location. 3. Nuclear facilities — Safety measures. I. International Atomic Energy Agency. II. Series.

IAEAL

15-00971

FOREWORD

by Yukiya Amano
Director General

The IAEA's Statute authorizes the Agency to “establish or adopt... standards of safety for protection of health and minimization of danger to life and property” — standards that the IAEA must use in its own operations, and which States can apply by means of their regulatory provisions for nuclear and radiation safety. The IAEA does this in consultation with the competent organs of the United Nations and with the specialized agencies concerned. A comprehensive set of high quality standards under regular review is a key element of a stable and sustainable global safety regime, as is the IAEA's assistance in their application.

The IAEA commenced its safety standards programme in 1958. The emphasis placed on quality, fitness for purpose and continuous improvement has led to the widespread use of the IAEA standards throughout the world. The Safety Standards Series now includes unified Fundamental Safety Principles, which represent an international consensus on what must constitute a high level of protection and safety. With the strong support of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its standards.

Standards are only effective if they are properly applied in practice. The IAEA's safety services encompass design, siting and engineering safety, operational safety, radiation safety, safe transport of radioactive material and safe management of radioactive waste, as well as governmental organization, regulatory matters and safety culture in organizations. These safety services assist Member States in the application of the standards and enable valuable experience and insights to be shared.

Regulating safety is a national responsibility, and many States have decided to adopt the IAEA's standards for use in their national regulations. For parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by regulatory bodies and operators around the world to enhance safety in nuclear power generation and in nuclear applications in medicine, industry, agriculture and research.

Safety is not an end in itself but a prerequisite for the purpose of the protection of people in all States and of the environment — now and in the future. The risks associated with ionizing radiation must be assessed and controlled without unduly limiting the contribution of nuclear energy to equitable and sustainable development. Governments, regulatory bodies and operators everywhere must ensure that nuclear material and radiation sources are used beneficially, safely and ethically. The IAEA safety standards are designed to facilitate this, and I encourage all Member States to make use of them.

THE IAEA SAFETY STANDARDS

BACKGROUND

Radioactivity is a natural phenomenon and natural sources of radiation are features of the environment. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. The radiation risks to workers and the public and to the environment that may arise from these applications have to be assessed and, if necessary, controlled.

Activities such as the medical uses of radiation, the operation of nuclear installations, the production, transport and use of radioactive material, and the management of radioactive waste must therefore be subject to standards of safety.

Regulating safety is a national responsibility. However, radiation risks may transcend national borders, and international cooperation serves to promote and enhance safety globally by exchanging experience and by improving capabilities to control hazards, to prevent accidents, to respond to emergencies and to mitigate any harmful consequences.

States have an obligation of diligence and duty of care, and are expected to fulfil their national and international undertakings and obligations.

International safety standards provide support for States in meeting their obligations under general principles of international law, such as those relating to environmental protection. International safety standards also promote and assure confidence in safety and facilitate international commerce and trade.

A global nuclear safety regime is in place and is being continuously improved. IAEA safety standards, which support the implementation of binding international instruments and national safety infrastructures, are a cornerstone of this global regime. The IAEA safety standards constitute a useful tool for contracting parties to assess their performance under these international conventions.

THE IAEA SAFETY STANDARDS

The status of the IAEA safety standards derives from the IAEA's Statute, which authorizes the IAEA to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, and to provide for their application.

With a view to ensuring the protection of people and the environment from harmful effects of ionizing radiation, the IAEA safety standards establish fundamental safety principles, requirements and measures to control the radiation exposure of people and the release of radioactive material to the environment, to restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation, and to mitigate the consequences of such events if they were to occur. The standards apply to facilities and activities that give rise to radiation risks, including nuclear installations, the use of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

Safety measures and security measures¹ have in common the aim of protecting human life and health and the environment. Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.

The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. They are issued in the IAEA Safety Standards Series, which has three categories (see Fig. 1).

Safety Fundamentals

Safety Fundamentals present the fundamental safety objective and principles of protection and safety, and provide the basis for the safety requirements.

Safety Requirements

An integrated and consistent set of Safety Requirements establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future. The requirements are governed by the objective and principles of the Safety Fundamentals. If the requirements are not met, measures must be taken to reach or restore the required level of safety. The format and style of the requirements facilitate their use for the establishment, in a harmonized manner, of a national regulatory framework. Requirements, including numbered ‘overarching’ requirements, are expressed as ‘shall’ statements. Many requirements are not addressed to a specific party, the implication being that the appropriate parties are responsible for fulfilling them.

¹ See also publications issued in the IAEA Nuclear Security Series.

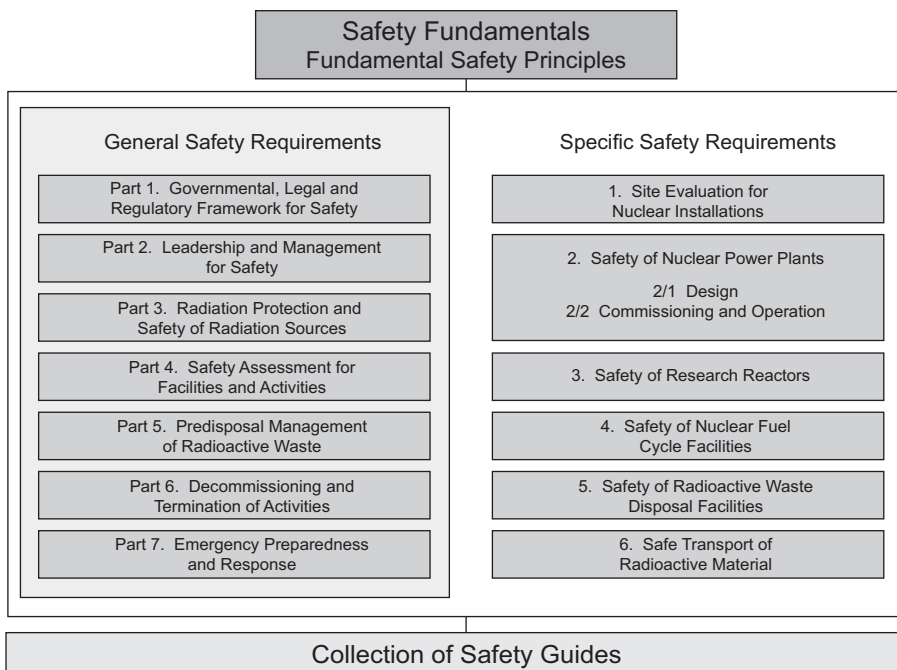


FIG. 1. The long term structure of the IAEA Safety Standards Series.

Safety Guides

Safety Guides provide recommendations and guidance on how to comply with the safety requirements, indicating an international consensus that it is necessary to take the measures recommended (or equivalent alternative measures). The Safety Guides present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety. The recommendations provided in Safety Guides are expressed as ‘should’ statements.

APPLICATION OF THE IAEA SAFETY STANDARDS

The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities. The IAEA safety standards are also used by co-sponsoring organizations and by many organizations that design, construct and operate nuclear facilities, as well as organizations involved in the use of radiation and radioactive sources.

The IAEA safety standards are applicable, as relevant, throughout the entire lifetime of all facilities and activities — existing and new — utilized for peaceful purposes and to protective actions to reduce existing radiation risks. They can be used by States as a reference for their national regulations in respect of facilities and activities.

The IAEA's Statute makes the safety standards binding on the IAEA in relation to its own operations and also on States in relation to IAEA assisted operations.

The IAEA safety standards also form the basis for the IAEA's safety review services, and they are used by the IAEA in support of competence building, including the development of educational curricula and training courses.

International conventions contain requirements similar to those in the IAEA safety standards and make them binding on contracting parties. The IAEA safety standards, supplemented by international conventions, industry standards and detailed national requirements, establish a consistent basis for protecting people and the environment. There will also be some special aspects of safety that need to be assessed at the national level. For example, many of the IAEA safety standards, in particular those addressing aspects of safety in planning or design, are intended to apply primarily to new facilities and activities. The requirements established in the IAEA safety standards might not be fully met at some existing facilities that were built to earlier standards. The way in which IAEA safety standards are to be applied to such facilities is a decision for individual States.

The scientific considerations underlying the IAEA safety standards provide an objective basis for decisions concerning safety; however, decision makers must also make informed judgements and must determine how best to balance the benefits of an action or an activity against the associated radiation risks and any other detrimental impacts to which it gives rise.

DEVELOPMENT PROCESS FOR THE IAEA SAFETY STANDARDS

The preparation and review of the safety standards involves the IAEA Secretariat and four safety standards committees, for nuclear safety (NUSSC), radiation safety (RASSC), the safety of radioactive waste (WASSC) and the safe transport of radioactive material (TRANSSC), and a Commission on Safety Standards (CSS) which oversees the IAEA safety standards programme (see Fig. 2).

All IAEA Member States may nominate experts for the safety standards committees and may provide comments on draft standards. The membership of the Commission on Safety Standards is appointed by the Director General and

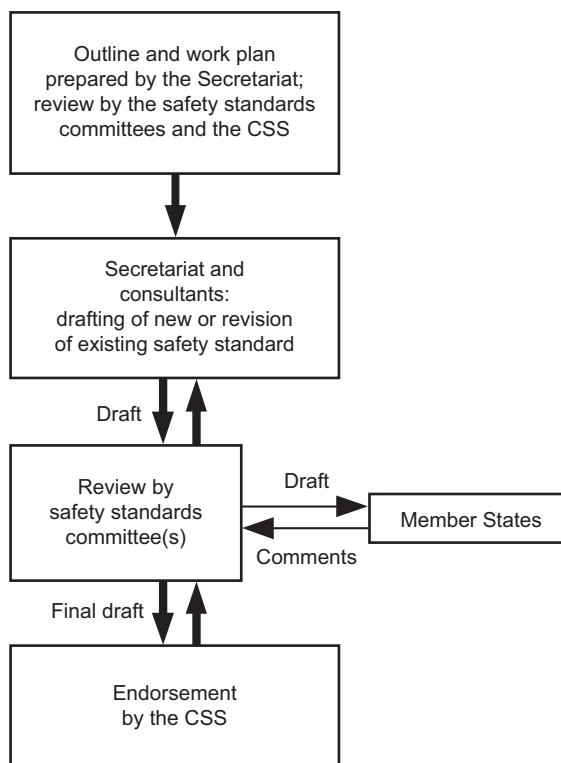


FIG. 2. The process for developing a new safety standard or revising an existing standard.

includes senior governmental officials having responsibility for establishing national standards.

A management system has been established for the processes of planning, developing, reviewing, revising and establishing the IAEA safety standards. It articulates the mandate of the IAEA, the vision for the future application of the safety standards, policies and strategies, and corresponding functions and responsibilities.

INTERACTION WITH OTHER INTERNATIONAL ORGANIZATIONS

The findings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of international expert bodies, notably the International Commission on Radiological Protection (ICRP), are taken into account in developing the IAEA safety standards. Some

safety standards are developed in cooperation with other bodies in the United Nations system or other specialized agencies, including the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, the International Labour Organization, the OECD Nuclear Energy Agency, the Pan American Health Organization and the World Health Organization.

INTERPRETATION OF THE TEXT

Safety related terms are to be understood as defined in the IAEA Safety Glossary (see <http://www-ns.iaea.org/standards/safety-glossary.htm>). Otherwise, words are used with the spellings and meanings assigned to them in the latest edition of The Concise Oxford Dictionary. For Safety Guides, the English version of the text is the authoritative version.

The background and context of each standard in the IAEA Safety Standards Series and its objective, scope and structure are explained in Section 1, Introduction, of each publication.

Material for which there is no appropriate place in the body text (e.g. material that is subsidiary to or separate from the body text, is included in support of statements in the body text, or describes methods of calculation, procedures or limits and conditions) may be presented in appendices or annexes.

An appendix, if included, is considered to form an integral part of the safety standard. Material in an appendix has the same status as the body text, and the IAEA assumes authorship of it. Annexes and footnotes to the main text, if included, are used to provide practical examples or additional information or explanation. Annexes and footnotes are not integral parts of the main text. Annex material published by the IAEA is not necessarily issued under its authorship; material under other authorship may be presented in annexes to the safety standards. Extraneous material presented in annexes is excerpted and adapted as necessary to be generally useful.

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1. INTRODUCTION

BACKGROUND

1.1. This Safety Guide was prepared under the IAEA's programme for safety standards. It supplements and provides recommendations on meeting the requirements for nuclear installations established in the Safety Requirements publication on Site Evaluation for Nuclear Installations (NS-R-3) [1] with respect to the safety aspects to be considered during the stages of the selection process for a site for a nuclear installation. The effects of external events occurring in the region of a particular site and the characteristics of the site and of its environment are factors that could influence the transfer to persons and to the environment of radionuclides that might be released over the operating lifetime of the nuclear installation. This Safety Guide complements other safety guides that deal with all safety considerations in site evaluation with regard to such factors. This Safety Guide also deals with the population density and population distribution and other characteristics of the external zone, in so far as they may affect the feasibility of taking emergency actions over the expected operating lifetime of the installation.

1.2. The IAEA Safety Fundamentals publication, Fundamental Safety Principles (SF-1) [2], establishes that “The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation” (para. 2.1). Principle 8 of SF-1 [2] on prevention of accidents states that “All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.” SF-1 [2] also establishes that “The primary means of preventing and mitigating the consequences of accidents is ‘defence in depth’” (para. 3.31). Defence in depth is provided by an appropriate combination of specified systems and measures, one of which is “Adequate site selection and the incorporation of good design and engineering features providing safety margins, diversity and redundancy” (SF-1 [2], para. 3.32). To apply this principle, it is required (NS-R-3 [1], para. 2.1) that the suitability of a site for a nuclear installation be evaluated with regard to the following:

- “(a) The effects of external events occurring in the region of the particular site (these events could be of natural origin or human induced);
- “(b) The characteristics of the site and its environment that could influence the transfer to persons and the environment of radioactive material that has been released;

“(c) The population density and population distribution and other characteristics of the external zone in so far as they may affect the possibility of implementing emergency measures and the need to evaluate the risks to individuals and the population.”

1.3. The selection and the evaluation of a site suitable for a nuclear installation are crucial. These processes can significantly affect the costs, public acceptance and safety of the installation over its operating lifetime. The outcome of this process may even affect the success of the nuclear power project. Poor planning and execution, lack of information and lack of knowledge of international safety standards and recognized good practices could lead to faulty decision making and could cause major delays, either at the construction stage or at the operational stage of a nuclear installation. Faulty decisions made at the site selection stage might necessitate major resource commitments at a much later phase of the project. If the site related design parameters are changed during the operational stage, re-evaluation of and upgrades to the installation during operation may consequently be necessary, possibly necessitating extended shutdown periods and causing considerable costs.

1.4. The selection process for a suitable site, termed ‘siting’, for a nuclear installation is a multifaceted process that includes safety considerations. With regard to accident prevention, siting is intended to prevent accidents arising from external hazards associated with external events. Siting involves a comprehensive process of screening out sites for which external hazards are significant or could become significant. Siting also involves screening out sites for which the additional safety measures in the design that would be necessary to address such hazards would be excessively demanding, or sites where knowledge is not sufficient to define these measures with a sufficient degree of confidence. With regard to mitigating the consequences of accidents, siting is intended to reduce the possible impacts of an accident on people and on the environment. It involves the selection of a site with favourable dispersion characteristics for radionuclides in the air, in surface water and subsurface water, and also with a terrain, population distribution and infrastructure that would facilitate the implementation of an emergency plan.

1.5. The siting process, from the beginning, has to be guided by a clearly established set of criteria consistent with the relevant regulatory requirements. Such criteria are of particular importance for those factors for which sites can be excluded. A balance has to be established between the characteristics of a site and specific design features, site protection measures and administrative procedures.

1.6. The Safety Requirements publication NS-R-3 [1] was published in 2003 (under revision). That safety standard deals with the requirements for the full characterization of the site for a nuclear installation from the safety point of view, covering the entire process of the site evaluation, from the site selection stage to site characterization and the pre-operational and operational stages. Thus, NS-R-3 [1] does not cover the initial stage of the siting process, the site survey, which is when studies and investigations are performed at the regional level to identify potential sites, from which candidate sites are chosen.

1.7. The previous IAEA Safety Guide on Site Survey for Nuclear Power Plants (50-SG-S9), was published in 1984¹. This revision was necessary to update the recommendations and guidance and to bring the Safety Guide into consistency with the existing safety requirements established in NS-R-3 [1], particularly as they relate to exclusionary criteria, and with other Safety Guides that provide recommendations relevant to the early stages of site evaluation, especially Refs [3–9].

1.8. The approach in this Safety Guide ensures that issues associated with site safety are considered early in the process and that alternative sites are available in the event that the selected site does not meet the requirements on the basis of the detailed site characterization. It is important that external hazards are identified early to allow for adequate consideration of protective measures that may be necessary to provide sufficient defence in depth.

1.9. Terms in this publication are to be understood as defined and explained in the IAEA Safety Glossary [10], unless otherwise stated.

OBJECTIVE

1.10. The objective of this Safety Guide is to provide recommendations and guidance on meeting the requirements [1] for the consideration of safety in the siting process for a nuclear installation in order to meet the fundamental safety objective of SF-1 [2]. Recommendations are provided for criteria and approaches for identifying suitable sites for nuclear installations that comply with established safety requirements. The Safety Guide provides recommendations and guidance on establishing a systematic process for site survey and site selection for

¹ INTERNATIONAL ATOMIC ENERGY AGENCY, Site Survey for Nuclear Power Plants, Safety Series No. 50-SG-S9, IAEA, Vienna (1984).

a number of preferred candidate sites, from which one could be selected for the construction and operation of a nuclear installation.

1.11. This Safety Guide is intended for use by organizations with an interest in the siting process, including government bodies, future licensees (generally the operating organizations) and their contractors. This Safety Guide also has an informative role for the regulatory body as, in most States, siting is a non-regulated process and does not require regulatory actions.

SCOPE

1.12. This Safety Guide addresses the consideration of safety in the siting process for a nuclear installation. It is recognized that there are other important factors in the siting process, possibly regarding both safety and non-safety issues, such as nuclear security considerations, technology, economics, land use planning, availability of cooling water, non-radiological environmental impacts and socioeconomic impacts, among them the opinion of interested parties, including the public. As the siting process progresses, more and more sites are screened out. For the few potential sites that remain, safety considerations will become more pronounced.

1.13. The difference between the investigation processes of site survey and site evaluation may not be very distinct and will depend on the methodology and technology used. There is a transition between these two stages of assessment. This Safety Guide covers the process that eventually terminates in the site selection for one or more nuclear installations. It covers site evaluation only to the extent necessary for understanding the context.

1.14. As well as providing recommendations and guidance on the siting of a nuclear installation at a new site, this Safety Guide also provides recommendations with regard to the location of a new installation at an existing site.

1.15. This Safety Guide addresses a range of types of nuclear installation². The methodologies recommended for nuclear power plants can be applied to other nuclear installations through a graded approach. The recommendations can be tailored to meet requirements for different types of nuclear installation in accordance with the potential radiological consequences of accidents. The recommended direction of grading is to start with attributes relating to nuclear power plants and, if possible, to grade down to installations with which lesser radiological consequences are associated.³ If no grading is performed, the recommendations relating to nuclear power plants (Sections 2–5) are applicable to other types of nuclear installation.

1.16. This Safety Guide does not provide recommendations and guidance on site characterization and does not establish an assessment of site hazards for use in a design evaluation for licensing purposes. The guidelines for final site characterization or re-evaluation as part of a periodic safety review are given in Refs [4–9].

1.17. This Safety Guide refers to but does not provide guidance on considerations relating to nuclear security. Nuclear security is covered in the IAEA Nuclear Security Series of publications.

STRUCTURE

1.18. Section 2 addresses the siting and site evaluation processes. Section 3 provides general recommendations for site selection for a nuclear installation. Section 4 describes the classification of criteria for the siting process. Section 5 provides recommendations and guidance with regard to investigations necessary for the different stages of the site survey and site selection process (for the compilation of a database). Section 6 deals with the site survey and site selection process for a nuclear installation other than

² The term ‘nuclear installation’ includes: nuclear power plants; research reactors (including subcritical and critical assemblies) and any adjoining radioisotope production facilities; spent fuel storage facilities; facilities for the enrichment of uranium; nuclear fuel fabrication facilities; conversion facilities; facilities for the reprocessing of spent fuel; facilities for the predisposal management of radioactive waste arising from nuclear fuel cycle facilities; and nuclear fuel cycle related research and development facilities.

³ For sites at which nuclear installations of different types are collocated, particular consideration should be given to the use of a graded approach so that siting evaluation is commensurate with the approach needed for the most potentially hazardous nuclear installations.

a nuclear power plant and recommends a graded approach for dealing with such installations. Section 7 provides recommendations for the management system. The Appendix provides recommendations for the database for the siting process. Annex I presents tables to be used in the siting process, including criteria for screening and ranking. Annex II provides example criteria for the siting process for nuclear power plants. The numerical values provided in the annexes are only examples of those used in some States.

2. GENERAL DESCRIPTION OF THE SITING PROCESS AND THE SITE EVALUATION PROCESS

2.1. There are two processes relating to the safety considerations for the site of a nuclear installation — the siting process and the site evaluation process. These two processes are further split into five stages:

- Site survey stage;
- Site selection stage;
- Site characterization stage (site verification and site confirmation);
- Pre-operational stage;
- Operational stage.

The framework for the site survey stage and the site evaluation stage is elaborated in the schematic representation shown in Fig. 1.

2.2. Siting is the process of surveying and selecting a suitable site for a nuclear installation. The selection of a suitable site is one of the elements of the concept of defence in depth for preventing accidents as stated in Principle 8 of SF-1 [2].

2.3. The siting process and the site evaluation process include five different stages. The siting process for a nuclear installation consists of the first two stages of these five, i.e. site survey and site selection (see Fig. 1). In the site survey stage, large regions are investigated to find potential sites and to identify one or more candidate sites. The second stage of the siting process is site selection, in which unsuitable sites are rejected and the remaining candidate sites are assessed by screening and comparing them on the basis of safety and other considerations to arrive at the preferred candidate sites.

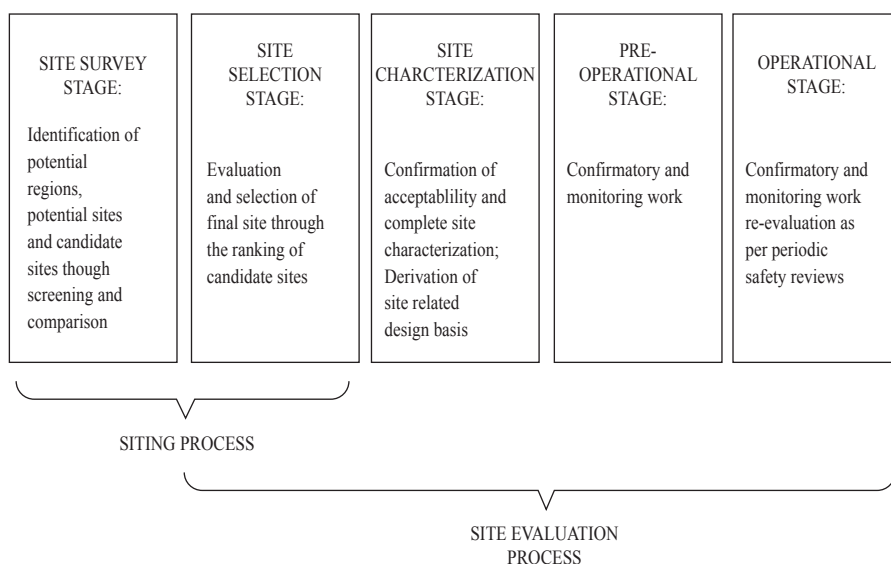


FIG. 1. Stages in the siting process and site evaluation process in the operating lifetime of a nuclear installation.

2.4. Site evaluation⁴ is the process that extends from: (a) the last stage of the siting process (i.e. the stage of evaluation of the candidate sites in order to arrive at the preferred candidate site(s)); to (b) the detailed site characterization stage for the selected site to confirm its suitability, its characterization and derivation of the site related design basis for the nuclear installation; to (c) the confirmation and completion of the assessment at the pre-operational stage for the installation (i.e. during the design, construction, assembly and commissioning stages); and finally to (d) the operational stage of the installation included within the framework of periodic safety review (see paras 1.8 and 1.14 of NS-R-3 [1], and Ref. [10]). Thus, site evaluation continues throughout the operating lifetime of the installation, with appropriate components covered in the final safety analysis report, to take into account changes in site characteristics, the availability

⁴ Site evaluation is defined as the analysis of factors at a site that could affect the safety of a facility or activity on that site. This includes site characterization and consideration of factors that could affect safety features of the facility or activity so as to result in a release of radioactive material and/or could affect the dispersion of such material in the environment, as well as population and access issues relevant to safety (e.g. feasibility of evacuation, location of people and resources) [10].

of data and information, operational records, regulatory approaches, evaluation methodologies and safety standards [1, 4–9].

2.5. The second stage of the siting process, site selection, includes part of the site evaluation process and is the overlapping stage between the siting process and the site evaluation process (see Figs 1 and 2). After the site selection stage, the suitability of the site is confirmed and a complete site characterization⁵ is performed, together with finalizing the derivation of the design basis due to external events during the site characterization stage. This process eventually leads to the preparation of the site evaluation report as a basis for the ‘site’ section of the preliminary safety analysis report⁶ for the nuclear installation. All the site related activities involving confirmatory and monitoring work are taken up in the pre-operational stage⁷. Following the approval of the final safety analysis report for the nuclear installation, the site evaluation at the operational stage⁸ starts. This includes all confirmatory, monitoring and re-evaluation work conducted throughout the operational stage, and especially during periodic safety reviews of the installation. This work is generally reported in periodic safety review reports. Outcomes in comparison with those for the stages of the siting process and the site evaluation process are shown in Fig. 2.

2.6. In most States, siting is a non-regulated activity and no licence is required. Siting and site evaluation processes should be consistent with the licensing process as specified by the regulatory body and should also be consistent with the applicable IAEA safety standards [11, 12].

⁵ The site characterization stage is further subdivided into: site verification, in which the suitability of the site to host a nuclear installation is verified mainly according to predefined site exclusion criteria, and site confirmation, in which the characteristics of the site necessary for the purposes of analysis and detailed design are determined [10].

⁶ Other terms are used in some States, e.g. preliminary safety case.

⁷ In the pre-operational stage, studies and investigations begun in the previous stages are continued after the start of construction and before the start of operation of the nuclear installation, to complete and refine the assessment of site characteristics. The site data obtained allow a final assessment of the simulation models used in the final design.

⁸ At the operational stage, appropriate safety related site evaluation activities are carried out over the operating lifetime of the nuclear installation, mainly by means of monitoring and periodic safety review.

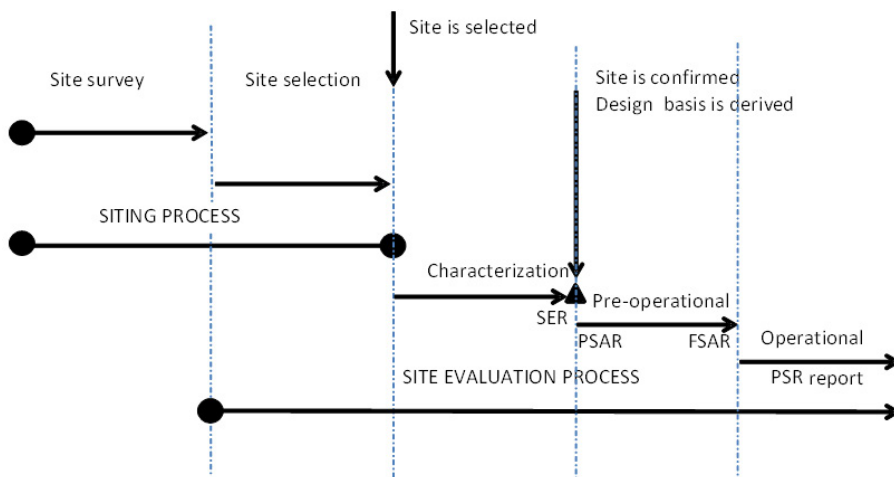


FIG. 2. Outcome of the siting process and site evaluation process for a nuclear installation. FSAR: final safety analysis report; PSAR: preliminary safety analysis report; PSR: periodic safety review; SER: site evaluation report.

2.7. There are three important steps that should receive input from site survey, site selection and the site evaluation process before construction starts. These are:

- The decision regarding the suitability of the preferred site, i.e. confirmation that the site has no characteristics that would preclude the safe operation of a nuclear installation;
- The definition of the site related design basis parameters on the basis of the site evaluation report;
- The preparation of the preliminary safety analysis report or preliminary safety case which, among other things, demonstrates that the site related design basis parameters have been appropriately taken into account, in particular through the design features of the nuclear installation and the measures to be taken for site protection.

2.8. The site should be deemed unsuitable for the purposes of the licensing of the proposed installation if it is concluded during characterization of external hazards that no engineering solutions exist to design protective measures against those hazards that challenge the safety of the nuclear installation, or there are no adequate measures to protect people against unacceptable radiological risks.

2.9. The future operator of the proposed installation on the site should have an early role to play in reviewing and accepting work done during siting, even if the future operator does not have a direct role in selecting the site.

3. GENERAL RECOMMENDATIONS FOR THE SITING PROCESS

SITING PROCESS

3.1. The siting process is intended to select suitable locations for the envisaged nuclear installation such that its characteristics are compatible with available engineering protective measures for all natural and human induced hazards arising from external events, so that the necessary level of safety can be achieved. Furthermore, the surrounding demographic setting and dispersion characteristics should be such as to limit the exposure of the population for any plant state to as low as reasonably achievable, and to allow the implementation of measures for mitigating the consequences of any accidental release of radionuclides over the operating lifetime of the installation.

3.2. The siting process consists of a series of related activities with the objective of selecting suitable sites for a new nuclear installation. The process should systematically and successively apply a number of screening criteria to screen out those sites with attributes which contribute unfavourably to the safety of the installation. A flow chart of the siting process for a nuclear installation is given in Fig. 3.

3.3. The siting process has three distinct steps starting with the region(s) of interest as given.

- (1) *Regional analysis*: This is the first step, in which region(s) of interest are analysed to identify potential sites. All potential sites in a region should be taken to the next step (screening) unless their exclusion can be appropriately justified.
- (2) *Screening*: In the second step, the potential sites are screened to choose the candidate sites. The principal objective of this step is to exclude unfavourable sites on the basis of both safety related considerations and non-safety-related considerations.