



International Atomic Energy Agency

Requirements for Site Evaluation

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Objective of Site Evaluation

- **To fully characterise the site specific conditions pertinent to the safety of a nuclear installation.**
- **The main safety objective in site evaluation is the protection of the public and environment from normal and accidental releases of radioactive material**

Purpose of the Site Evaluation

- **To establish requirements for criteria, to be applied as appropriate, to site and site-installation interaction in operational states and accident conditions, including those that could lead to emergency measures for;**
 - **Defining the extent of information on a proposed site to be presented by an applicant,**
 - **Evaluating a proposed site to ensure that the site related phenomena and characteristics are adequately taken into account,**
 - **Analysing the characteristics of the population of the region and the capability of implementing emergency plans over the projected lifetime of the plant,**
 - **Defining site related hazards.**

Grading of Site Evaluation

- **The level of detail required in an evaluation will vary according to the type of installation being sited.**
- **Depending on the level of risk posed by the installation, less detail and smaller areas of coverage may be necessary to comply with national and international requirements.**

General Requirements

- **In the evaluation of the suitability of a site for a nuclear installation, the following aspects shall be considered;**
 - **The effects of external events occurring in the region of a particular site. (These events could be of natural origin or arising from human activity.)**
 - **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,**
 - **The population density and 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 risks to individuals and the population.**

Uses of Site Evaluation

- **Provide a technical basis for the safety analysis report submitted to the regulatory body as part of the licensing process.**
- **Fulfilment of the requirements for the environmental impact assessment for radiological hazards.**

General Criteria I

- **Site characteristics that may affect the safety of the nuclear installation shall be investigated and assessed.**
- **Characteristics of the natural environment in the region that may be affected by potential radiological impacts in operational states and accident conditions shall be investigated.**
- **All these characteristics shall be monitored through out the lifetime of the installation.**

General Criteria II

- Proposed sites shall be examined with regard to the frequency and severity of external natural and human induced events and phenomena that could affect the safety of the installation.
- The foreseeable evolution of natural and human made factors in the region that may have a bearing on safety shall be evaluated for a time period that encompasses the projected lifetime of the nuclear installation. If necessary, measures shall be taken to ensure that the overall risk remains acceptably low.
- These measures include design features, measures for site protection and administrative procedures. Of these, the first two are the preferred options.

3 Main Criteria Types

- **Criteria for hazards associated with external events and human induced events**
- **Criteria for determining the potential effects of the nuclear installation in the region**
- **Criteria derived from considerations of population and emergency planning**

Criteria for hazards associated with external events and human induced events

- Possible natural phenomena and human induced situations and activities in the region of the proposed site shall be identified and evaluated according to their significance for the safe operation of the nuclear installation.
- The evaluation shall be used to identify the important phenomena or situations.
- Foreseeable significant changes in land use shall be considered.
- The methods used in the assessment shall be up to date and compatible with the characteristics of the region.
- (Probabilistic hazard curves will generally be needed.)
- Phenomena shall be expressed in terms that can be used as design and assessment input.

Criteria for determining the potential effects of the nuclear installation in the region

- **The site shall be evaluated to determine the potential radiological impact on the region for operational states and accident conditions that could lead to the need for emergency measures.**
- **Appropriate estimates shall be made of the expected or potential releases of radioactive material, taking into account the design of the installation.**
- **Direct and indirect pathways shall be identified, evaluated and shown to be acceptably low.**

Criteria derived from considerations of population and emergency planning

- **The proposed site shall be studied to evaluate the present and foreseeable future characteristics and the distribution of the population.**
- **Account shall be taken of the feasibility of implementing emergency plans together with any external phenomena that may hinder their implementation.**

Earthquakes and Surface Faulting

- **The seismological and geological conditions in the region shall be evaluated.**
- **A thorough uncertainty analysis shall be performed as part of the evaluation.**
- **The potential for surface faulting shall be assessed.**
- **Where reliable evidence shows the existence of a capable fault that has the potential to affect the safety of the installation, an alternative site shall be considered.**

Meteorological Events

- **The meteorological and climatological characteristics for the region around the site shall be investigated.**
- **The potential for extreme wind, precipitation, snow, temperature, storm surges, lightning, tornadoes, and cyclones/hurricanes shall be determined.**
- **Determination shall include not only the effects of the event itself but the potential for associated hazards, e.g. missile generation as a result of high winds.**
- **The output shall be described in a manner that is suitable for design purposes.**

Flooding

- **The region shall be assessed to determine the potential for flooding due to one or more natural causes such as runoff resulting from precipitation or snow melt, high tide, storm surge and wind waves.**
- **Assessment shall also be made of water waves caused by earthquakes, other geological phenomena and flooding caused by failure of water control structures (dams).**
- **The potential for associated instability of the coastal area or river channel due to erosion or sedimentation shall also be investigated.**

Geotechnical Hazards

- **The site and its vicinity shall be evaluated to determine the potential for;**
 - **Slope instability,**
 - **Collapse, subsidence or uplift of the site surface,**
 - **Soil liquefaction, and**
 - **Behaviour of foundation materials.**

External Human Induced Events

- **The potential for extreme human induced events shall be considered. These include;**
 - Aircraft crash,
 - Chemical explosions,
 - Toxic gas clouds, and
 - Nearby firing ranges.
- **Factors that could lead to loss of heatsink include;**
 - Blockage of rivers,
 - Depletion of reservoirs,
 - Marine organisms,
 - Ship collisions/oil spills/oil fires

Atmospheric Dispersion of Radioactive Material

- A meteorological description of the region shall be developed, including description of the basic meteorological parameters, regional orography and phenomena such as wind speed and direction, air temperature, precipitation, humidity, atmospheric stability parameters and prolonged atmospheric inversions.
- The atmospheric dispersion of radioactive material shall be assessed on the basis of the above data.

Dispersion of Radioactive Material through Surface Water

- **A description of the surface hydrological characteristics of the region shall be developed, including descriptions of the main characteristics of water bodies, both natural and artificial, the major structures for water control, the locations for water intake structures and information on water use in the region.**

Dispersion of Radioactive Material through Groundwater

- **A description of the groundwater hydrology of the region shall be developed, including descriptions of the main characteristics of the water bearing formations, their interaction with surface waters and data on the uses of groundwater in the region.**

Population Distribution

- **The distribution of population within the region shall be determined.**
- **The projected population distributions in the region shall also be determined and kept up to date over the lifetime of the facility.**
- **Special attention shall be paid to the population living in the immediate vicinity of the installation, to densely populated areas and population centres in the region and to residential institutions such as schools and hospitals.**

Ambient Radioactivity

- **Prior to commissioning of the installation, the ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region shall be assessed in order to provide a baseline against which the operation of the installation can be compared over time.**

Monitoring of Hazards

- **The characteristics of the natural and human induced hazards as well as demographic, meteorological and hydrological conditions of relevance to the installation shall be monitored over the lifetime of the installation as part of maintaining an adequate level of safety.**

Quality Assurance

- **An adequate quality assurance programme shall be established to control the effectiveness of the execution of the site investigations and assessments.**
- **The QAP is part of the overall programme for the installation and needs to be in place long before the establishment of the nuclear project.**