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Republic of the Philippines
Department of Science and Technology
PHILIPPINE NUCLEAR RESEARCH INSTITUTE
Commonwealth Avenue, Diliman, Quezon City

CPR PART 5

REQUIREMENTS FOR SITING OF NUCLEAR INSTALLATIONS

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REQUIREMENTS FOR SITING OF NUCLEAR INSTALLATIONS

I. GENERAL PROVISIONS

Section 1. Purpose.

(a) This Part is promulgated pursuant to Republic Act No. 2067, otherwise known as the Science Act of 1958, as amended by Republic Act No. 3589, and Republic Act No. 5207, otherwise known as the Atomic Energy Regulatory and Liability Act of 1968, as amended by Presidential Decree No. 1484, to establish the requirements for the siting of nuclear installations in the Philippines;

(b) This Part establishes the requirements for site selection and evaluation to determine the suitability of sites prior to the construction of nuclear installations and to fully characterize the site specific conditions pertinent to the safety of the nuclear installation;

(c) This Part also establishes the requirements for criteria to be applied as appropriate to site and site installation interactions in operational states and accident conditions, including those interactions that could lead to conditions that warrant emergency response actions, such as:
   (1) Defining the extent of information on a proposed site to be submitted by the applicant or licensee;
   (2) Evaluating a proposed site to ensure that the site related phenomena and characteristics are adequately taken into account;
   (3) Analyzing the characteristics of the population of the region and the capability of implementing emergency plans over the projected lifetime of the installation;
   (4) Defining site related hazards.

Section 2. Scope.

(a) The scope of this regulation encompasses site related factors and site installation interaction factors relating to plant operational states and accident conditions, including those that could lead to emergency measures, and

natural and human induced events external to the installation that are important to safety. The external human induced events considered in this regulation are all of accidental origin.

(b) This Part only establishes requirements to siting of a nuclear installation.

(c) Criteria specifically related to non-safety aspects and other criteria that may be considered in the selection stage of the site such as land use planning, cooling water availability, socio-economic impacts including public opinion, traffic arrangements, reliable electric power transfer to the national grid are not considered in this Part.

(d) The requirements pertaining to site preparation of the nuclear installation are outside the scope of this Part.

(e) This Part does not relieve the applicant or licensee from complying with the applicable rules and regulations of other responsible government agencies.

Section 3. Definitions.

As used in this part:

(a) ***"Act"*** means Republic Act No. 2067, otherwise known as the Science Act of 1958, as amended by Republic Act No. 3589, and Republic Act No. 5207, otherwise known as the Atomic Energy Regulatory and Liability Act of 1968, as amended by Presidential Decree No. 1484;

(b) ***"CPR"*** or ***"Code"*** means the Code of PNRI Regulations;

(c) ***"External Event"*** means an event unconnected with the operation of a facility or activity which could have an effect on the safety of the facility of activity.

(d) ***"External Zone"*** means the area immediately surrounding a proposed site area in which population distribution and density, and land and water uses, are considered with respect to their effects on the possible implementation of emergency measures;

(e) ***"Nuclear Installation"*** means any nuclear facility subject to authorization that is part of the nuclear fuel cycle, except, for the purpose of this Part, facilities for the mining, processing of uranium ores or thorium ores, refining, conversion, enrichment and fabrication of fuel (including mixed oxide (MOX) fuel) and radioactive waste disposal facilities;

(f) ***"Site"*** means a geographical area that contains an authorized nuclear installation, and within which the management of the authorized nuclear installation may directly initiate emergency actions;

The siting process for a nuclear installation generally consists of an investigation of a large region to select one or more candidate sites (site survey), followed by a detailed evaluation of those candidate sites. This Part is primarily concerned with the latter stage.

(g) ***"Siting"*** means the process of selecting a suitable site for a nuclear installation, including appropriate assessment and definition of the related design bases.

(1) ***"Site survey"*** means process of identifying candidate sites for a nuclear installation after the investigation of a large region and the rejection of unsuitable sites;

(2) ***"Site selection"*** means process of assessing the remaining sites by screening and comparing them on the basis of safety and other considerations to select one or more preferred candidate sites;

(3) ***"Site evaluation"*** means consideration of factors that could affect safety features of the facility as well as population and access issues relevant to safety (e.g. feasibility of evacuation);

(h) ***"Structures, Systems and Components (SSCs)"*** is a general term encompassing all the elements of a facility or activity which contributes to protection and safety, except human factors. Structures are the passive elements such as building vessels and shielding. A system comprises several components assembled in such a way as to perform a specific active function and a component is a discrete element of a system;

(i) ***"Tsunami"*** means water waves induced by earthquakes or other geological phenomena.

II. GENERAL REQUIREMENTS

Section 4. Objectives.

(a) The main objective of site evaluation is to ensure that a nuclear installation constructed at the site will not create an unreasonable risk to the public or to the environment. A systematic process for prioritizing the risks associated with site characteristics and external events shall be documented by the applicant or licensee and shall include consideration of the synergy of multiple events and multiple effects of different activities on the site.

Evaluation of site suitability shall include consideration of:

(1) the effects of external events (natural origin or human induced) occurring in the vicinity of the site;
(2) 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;
(3) 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.

(b) If the site evaluation for the three (3) aspects cited above indicates that the site is unacceptable and the deficiencies cannot be compensated for by

means of design features, measures for site protection or administrative procedures, the site shall be deemed unsuitable by the applicant or licensee.

Section 5. General Criteria.

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. These characteristics shall be observed and monitored throughout the lifetime of the installation.

(a) Proposed sites for a nuclear installation shall be evaluated with regard to the frequency and severity of external natural and human induced events, and potential combinations of such events, that could affect the safety of the installation.

(b) Information on frequency and severity derived from the characterization of the hazards resulting from external events shall be used in establishing the design basis hazard level for the nuclear installation. Account shall be taken of uncertainties in the design basis hazard level.

(c) In the analysis to determine the suitability of the site, consideration shall be given to additional safety matters such as the storage and transport of input and output materials such as fresh fuel, spent fuel, and radioactive wastes.

(d) The possible non-radiological impact of the installation, due to chemical or thermal releases, and the potential for explosion and the dispersion of chemical products shall be taken into account in the site evaluation process.

(e) The potential for interactions between nuclear and non-nuclear effluents, such as the combination of heat or chemicals with radioactive material in liquid effluents, shall be considered.

(f) The potential radiological impacts, including impacts that could lead to emergency measures, on people in the region, of the nuclear power reactor in operational states and in accident conditions, shall be evaluated considering population distribution, dietary habits, use of land and water, and the radiological impacts of any other releases of radioactive material.

(g) For nuclear power plants, the total nuclear capacity to be installed on the site shall be envisaged at the first stages of the siting process. If it is proposed to increase the installed nuclear capacity to a level significantly greater than that previously determined to be acceptable, the suitability of the site shall be re-evaluated.

(h) An assessment shall be made of the feasibility of implementation of emergency plans. All on-site and collocated installations shall be considered in the assessment, with special emphasis on nuclear installations that could concurrently experience accidents.

Section 6. Criteria for Hazards Associated with External Natural and Human Induced Events.

(a) Proposed sites shall be investigated with regard to all the site characteristics that could be significant with respect to safety as a result of external natural and human induced events. Degree of focus given to site characteristics and external events shall be dependent on their probability and severity.

(b) Possible natural phenomena and human induced situations and activities in the region of a proposed site shall be identified and evaluated to determine their significance to the safe operation of the nuclear installation.

(c) Parameters for describing the hazards associated with natural and human induced phenomena shall be selected or developed.

(d) The hazards associated with external events that are to be considered in the design of the nuclear installation and in its safety assessment shall be determined. For an external event, or a combination of events, the parameters and the values of those parameters that are used to characterize the hazards shall be chosen so that they can be used easily in the design of the installation and in its safety assessment.

(e) In the derivation of the hazards associated with external events, consideration shall be given to the effects of the combination of these hazards with the ambient conditions (e.g. hydrological, hydrogeological and meteorological conditions).

(f) Foreseeable significant changes in land use shall be considered, such as changes to existing installations or human activities, or the construction of high-risk installations.

(g) All relevant available information and records of the occurrences and severity of important natural phenomena or human induced situations and activities shall be collected for the region and shall be analyzed for reliability, accuracy and completeness.

(h) Appropriate methods shall be adopted for establishing the hazards that are associated with major external phenomena. The methods shall be justified in terms of being up-to-date and compatible with the characteristics of the region. Special consideration shall be given as far as practicable to applicable probabilistic methodologies including uncertainties. When applying a method to establish the hazards associated with major external phenomena the size of the region shall be chosen carefully. It shall be large enough to include all the features and areas that could be of significance in determining the natural and human induced phenomena under consideration and for the characteristics of the event.

(i) Major natural and human-induced phenomena shall be expressed in terms that can be used as input for deriving the hazards associated with the nuclear installation; that is, appropriate parameters for describing the hazard shall be selected or developed.

(j) In the determination of hazards, site-specific data shall be used, unless such data are unobtainable. In this case, data from other regions that are sufficiently relevant to the region on interest may be used in the determination of hazards. Appropriate and acceptable simulation techniques may also be used. In general, data obtained for similar regions and simulation techniques may also be used to augment the site-specific data.

Section 7. Criteria for Determining the Potential Effects of the Nuclear Installation in the Region.

(a) In the evaluation of a site to determine potential radiological impact of the nuclear installation on the region, for operational states and accident conditions that could lead to emergency measures, appropriate estimates shall be made of expected or potential radioactive releases, taking into account the design of the nuclear installation and its safety features. These estimates shall be confirmed when the design and its safety features have been approved by PNRI.

(b) The direct and indirect pathways by which radioactive from the nuclear installation could potentially reach and affect people and the environment shall be identified and evaluated; in such an evaluation specific regional and site characteristics shall be taken into account, with special attention paid to the function of the biosphere in the accumulation and transport of radionuclides.

(c) The site and the design for the nuclear installation shall be examined in conjunction to ensure that the radiological risk to the public and the environment associated with radioactive releases is acceptably low as determined by PNRI.

(d) The design of nuclear installation shall be such as to compensate for any unacceptable potential effects of the installation on the region as determined by PNRI, or otherwise the site shall be deemed unsuitable.

Section 8. Criteria Derived from Considerations of Population and Emergency Planning.

(a) The proposed region shall be studied to evaluate the present and foreseeable future characteristics and the distribution of the population of the region. The study shall include an evaluation of present and future uses of land and water in the region. Account shall be taken of any special characteristics that may affect the potential consequences of radioactive releases for individuals and the population as a whole.

(b) In relation to the characteristics and distribution of the population, the combined effects of the site and the nuclear installation shall be such that:

(1) for operational states of the installation the radiological exposure of the population remains as low as reasonably achievable and in any case is in compliance with Philippines national regulations;

(2) the radiological risk to the population associated with accident conditions, including those that could lead to emergency measures being taken, is acceptably low.

(c) The external zone for a proposed site shall be established by taking into account the possible radiological consequences for people and the feasibility of implementing emergency plans, and of any external events or phenomena that may hinder their implementation. Before construction of the nuclear installation is started, it shall be confirmed that there will be no insurmountable difficulties in establishing an emergency plan for the external zone before the start of operation of the nuclear installation.

(d) If, after thorough evaluation, it is shown that no appropriate measures can be developed to meet the above mentioned requirements, the site shall be deemed unsuitable.

III. REQUIREMENTS FOR EVALUATION OF EXTERNAL EVENTS.

Section 9. Earthquakes, Surface Faulting and Volcanoes.

(a) **Earthquakes:**

(1) The seismological and geological conditions in the region and the engineering geological aspects and geotechnical aspects of the proposed site of a nuclear installation shall be evaluated.

(2) Information on prehistorical, historical and instrumentally recorded earthquakes in the region shall be collected and documented.

(3) The hazards associated with earthquakes shall be determined by means of seismotectonic evaluation of the region with the use to the greatest possible extent of the information collected.

(4) A probabilistic seismic hazard assessment shall be performed to quantify the probability of exceeding a horizontal peak ground acceleration (pga) at a site given all possible earthquakes. A sensitivity analysis of the parameters used shall also be performed.

(5) Hazards due to earthquakes induced ground motion shall be assessed for the site with account taken of the seismotectonic characteristics of the region and specific site conditions. A thorough uncertainty analysis shall be performed as part of the evaluation of seismic hazards.

(b) **Surface Faulting:**

(1) The potential for surface faulting shall be assessed for the site. The methods to be used and the investigations to be made shall be sufficiently detailed that a reasonable decision can be reached.

(2) A fault shall be considered capable if, on the basis of geological, geophysical, geodetic, or seismological data including palaeoseismological and geomorphological data, one or more of the following conditions applies:

(i) The fault shows evidence of past movement or movements of a recurring nature (significant deformations or dislocations) within such a period that it is reasonable to infer that further movements at or near the surface could occur;

(ii) A structural relationship with a known capable fault has been demonstrated such that movement of the one may cause movement of the other at or near the surface; and

(iii) The maximum potential seismic event associated with the seismogenic structure is sufficiently large and at such a depth that it is reasonable to infer that, in the geodynamic setting of the site, movement at or near the surface could occur.

The time-span for the assessment of capable fault is proportional to recurrence intervals of seismic events.

Seismotectonic evaluation is conducted for the region using geophysical data and information on geotechnical hazards. The effects of seismic events and capable faults on sub-surface contamination transport are also evaluated for the region.

(3) Where reliable evidence shows the evidence of a capable fault that has the potential to affect the safety of the nuclear power reactor, an alternative site shall be considered.

(c) **Volcanoes:**

(1) An initial assessment shall be carried out to define a geographical region around the site that encompasses all sources of volcanic activity that may have occurred during the past 10 Ma. The geographical region will depend on the nature and type of volcanic phenomena without predetermined, uniform dimensions, but shall be determined on the basis of the types of potentially hazardous phenomena resulting from volcanic activity which may have an impact on the safety of the nuclear power plant.

(2) Both deterministic and probabilistic methods shall be used to assess volcanic hazards.

(3) Detailed information for each of the volcanic sources and their context in the region shall be collected and compiled in a database. The database shall incorporate all the information that is necessary to support decisions at each stage of the volcanic hazard assessment. The structure of the database shall be sufficiently flexible as to accommodate increasing levels of detail in information, completeness and integration as the analysis progresses through advancing stages of complexity.

(4) An evaluation of all active volcanism in the region that could affect the safe operation of the NPP includes information on prehistoric, historic, and instrumentally-recorded volcanic activity in the region shall be carried out. The evaluation shall also consider:

(i) Characteristics of the volcanic source, such as seismic triggers, ash, and volatile gases;

(ii) Potential effects on ventilation systems;

(iii) Missiles that could have an impact on SSCs;

(iv) Potential abrasion or chemical impact on SSCs;

(v) Effects on air and water intakes;

(vi) Effects of static electricity generation on electrical or electronic SSCs;

(vii) Effects on off-site power supplies to the site; and

(viii) Effects on emergency plan execution.

Section 10. Meteorological Events.

The extreme values of meteorological variables and rare meteorological phenomena listed below shall be investigated for the site of any nuclear installation. The meteorological and climatological characteristics for the region around the site shall be investigated.

(a) **Extreme values of meteorological phenomena**:

(1) In order to evaluate their possible extreme values, the following meteorological phenomena shall be documented for an appropriate period of time: wind, precipitation, temperature and storm surges.

(2) The output of the site evaluation shall be described in a way that is suitable for design purposes for the installation, such as the probability of exceedance values relevant to design parameters. Uncertainties in the data shall be taken into account in this evaluation.

(b) **Rare meteorological events**:

(1) Lightning:

(i) The potential for the occurrence and the frequency and severity of lighting shall be evaluated for the site, including the influence of lightning events on the risks of natural fire hazards.

(2) Tornadoes:

(i) The potential for the occurrence of tornadoes in the region of interest shall be assessed on the basis of detailed historical and instrumentally recorded data for the region.

(ii) The hazards associated with tornadoes shall be derived and expressed in terms of parameters such as rotational wind speed, translational wind speed, radius of maximum rotational wind speed, pressure differentials and rate of change of pressure

(iii) In the assessment of the hazard, missiles that could be associated with tornadoes shall be considered

(3) Tropical cyclones:

(i) The potential for tropical cyclones in the region of the site shall be evaluated. If this evaluation shows that there is evidence of tropical cyclones or a potential for tropical cyclones, related data shall be collected.

(ii) On the basis of the available data and the appropriate physical models, the hazards associated with tropical cyclones shall be determined in relation to the site. Hazards for tropical cyclones include factors such as extreme wind speed, pressure and precipitation.

(iii) In the assessment of the hazards, missiles that could be associated with tropical cyclones shall be considered.

Section 11. Tsunami and Flood Hazards.

(a) **Tsunami:**

(1) The region shall be evaluated to determine the potential for tsunamis or seiches that could affect the safety of a nuclear installation on the site.

(2) If there is found to be such a potential, prehistorical and historical data relating to tsunamis or seiches affecting the shore region around the site shall be collected and critically evaluated for their relevance to the evaluation of the site and their reliability;

(3) On the basis of the available prehistorical and historical data for the region and comparison with similar regions that have been well studied with regard to these phenomena, the frequency of occurrence, magnitude and height of regional tsunamis or seiches shall be estimated and shall be used in determining the hazards associated with tsunamis or seiches, with account taken of any amplification due to the coastal configuration at the site.

(4) The potential for tsunamis or seiches to be generated by regional offshore seismic events shall be evaluated on the basis of known seismic records and seismotectonic characteristics.

(5) The hazards associated with tsunamis or seiches shall be derived from known seismic records and seismotectonic characteristics as well as from physical and/or analytical modelling. These include potential draw-down and runup that may result in physical effects on the site.

(b) **Flood Hazards:**

(1) The region shall be assessed to determine the potential for flooding due to one or more natural causes that may affect the safety of the nuclear power reactor. If there is a potential for flooding, all pertinent

data, including historical data, both meteorological and hydrological, shall be collected, documented and critically examined.

(2) A suitable meteorological and hydrological model shall be developed taking into account the limits on the accuracy and quantity of the data, the length of the historical period over which the data were accumulated, and all known past changes in relevant characteristics of the region.

(3) The possible combinations of the effects of several causes shall be examined.

(4) The hazards for the site due to flooding shall be assessed and input parameters necessary to support the design of nuclear power reactor SSCs against the adverse effects of flooding quantified.

(5) The potential for instability of the coastal area or water channel due to erosion or sedimentation shall be investigated.

Section 12. Geotechnical and Foundation Hazards.

(a) **Slope instability:**

(1) The site and its vicinity shall be evaluated to determine the potential for slope instability that could affect the safety of the nuclear power reactor.

(2) If there is found to be a potential for slope instability that could affect the safety of the nuclear power reactor, the hazard shall be evaluated by using parameters and values for the site specific ground motion.

(b) **Collapse, subsidence or uplift of the site surface:**

(1) Geological maps and other appropriate information for the region shall be examined for the existence of natural features such as caverns, karstic formations and human made features such as mines, water wells and oil wells. The potential for collapse, subsidence or uplift of the site surface shall be evaluated.

(2) If the evaluation shows that there is a potential for collapse, subsidence or uplift of the surface that could affect the safety of the nuclear power reactor, practicable engineering solutions shall be provided otherwise the site shall be deemed unsuitable.

(3) If practicable engineering solutions appear available, a detailed description of subsurface conditions obtained by reliable methods of investigation shall be developed for the purposes of determination of the hazards. The practicability of the proposed engineering solutions shall be confirmed before the site is deemed to be suitable.

(c) **Soil liquefaction:**

(1) The potential for liquefaction of the subsurface materials of the proposed site shall be evaluated by using parameters and values for the site specific ground motion and proven analytical methods.

(2) The evaluation shall include the use of accepted methods of soil investigation and analytical methods to determine the hazards.

(3) If the potential for soil liquefaction is found to be unacceptable, the site shall be deemed unsuitable unless practicable engineering solutions are demonstrated to be available.

(d) **Behaviour of foundation materials:**

(1) The geotechnical characteristics of the subsurface materials, including the uncertainties, shall be investigated and a soil profile for the site in a form suitable for design purposes shall be determined.

(2) The stability of the foundation material under static and seismic loading shall be assessed.

(3) The groundwater regime and the chemical properties of the groundwater shall be studied.

Section 13. External Human Induced Events.

(a) **Accidental aircraft crashes:**

(1) The potential frequency and severity of aircraft crashes on the site shall be assessed taking into account, to the extent practicable, characteristics of future air traffic and aircraft.

(2) If the assessment shows that there is a potential for an aircraft crash on the site that could affect the safety of the nuclear installation, then an assessment of the hazards shall be made taking into account all relevant plant engineered safety features such as the containment building.

(b) **Chemical hazards:**

(1) Activities in the region that involve the handling, processing, transport and storage of chemicals having a potential for explosions or for the production of gas clouds capable of deflagration, detonation or causing human fatality or illness due to toxicity shall be identified. The frequency and severity of such events shall be specified.

(2) Hazards associated with chemical explosions shall be expressed in terms of overpressure and toxicity (if applicable) taking into account the effect of distance.

(c) **Other important human induced events:**

(1) The region shall be investigated for installations (including installations within the site boundary) in which flammable, explosive, asphyxiant, toxic, corrosive or radioactive materials are stored, processed, transported and otherwise handled and that if released under normal or accident conditions could jeopardize the safety of the nuclear installation. This investigation shall also include installations that may give rise to missiles of any type that could affect the safety of the nuclear installation. The potential effects of electromagnetic interference, eddy currents in the ground and the clogging of air or water inlets by debris shall also be evaluated.

(2) For nuclear power plant sites located on navigable waterways, the evaluation shall consider the probability and potential effects of impact on the nuclear power plant cooling water intake structure and enclosed pumps by the various sizes, weights and types of barges or ships that normally pass the site, including any explosions incident to the collision. Applicants shall use this analysis to determine whether an additional source of cooling water is required.

IV. SITE CHARACTERISTICS AND THE POTENTIAL EFFECTS OF THE NUCLEAR INSTALLATION IN THE REGION

Section 14. Dispersion of Radioactive Materials in the Atmosphere.

(a) Meteorological parameters, including wind speed and direction, air temperature, precipitation, humidity, atmospheric stability and atmospheric turbulence, solar radiation, shall be evaluated. Regional topographic features such as valleys, hills, mountains, forest, coastline and large artificial structures shall be assessed.

(b) Regional radiation background and collective doses of the local population shall be evaluated. A programme for meteorological measurements shall be prepared and carried out at or near the site with the use of instrumentation capable of measuring and recording the main meteorological parameters at appropriate elevations and locations. Data from at least one full year before the time of application for a site permit shall be collected.

(b) On the basis of the data obtained and the dispersion models, the atmospheric dispersion of radioactive material shall be evaluated. The dispersion models shall include all significant site specific and regional topographic features and characteristics of the installation that may affect atmospheric dispersion.

(c) Before commissioning of the nuclear installation, the ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region shall be assessed so as to be able to determine the effects of the nuclear reactor. The data obtained are intended for use as a baseline in future evaluations.

(d) The following shall be evaluated:

(i) Radioactivity, including the rate of discharge of each important nuclide and the total activity of each important nuclide released in a specified period and variation of the rate of discharge of each important nuclide;
(ii) Chemical characteristics of the material released;
(iii) Physical properties of the material released;
(iv) Geometry and mechanical of the discharge.

Section 15. Dispersion of Radioactive Material through Surface Water.

(a) Description of the surface hydrological characteristics of the region shall be developed, including description of the main characteristics of the water bodies, both natural and artificial, the major structure for water control, the locations of water intake structure and information on water use in the region.

(b) Program of evaluation and measurements of the surface hydrology shall be carried out to determine, to the extent necessary, the dilution and dispersion characteristics for water bodies, the re-concentration ability of sediments and biota, and the determination of transfer mechanisms of radionuclides in the hydrosphere and of exposure pathways.

(c) Assessment of the potential impact of the contamination of surface water on the population shall be performed by using the collected data and information in a suitable model.

(d) The evaluation shall cover the dose assessment related to exposure pathways in the hydrosphere, considering the following:
(1) The source term for the discharge of radioactive materials to the environment;
(2) Hydrological, physical, physiochemical and biological characteristics governing the transport, diffusion and retention of radioactive material;
(3) Relevant food-chains leading to humans;
(4) Locations and amounts of water used for drinking and for industrial, agricultural and recreational purposes;
(5) Dietary and other relevant habits of the population, including special occupational activities such as the handling of fishing gear and recreational pursuits such as water sports and fishing.

(e) The following properties and parameters shall be estimated for radioactive discharges:
(1) Radioactivity;
(2) Chemical properties;
(3) Physical properties of the liquid effluents discharged;
(4) Flow rate for continuous discharges, or volume and frequency per batch discharge;
(5) Distance to nearest body of surface water;
(6) The variation of the source term over the duration of the discharge, which is necessary to evaluate the concentrations due to long term releases; and
(7) The geometry and mechanical discharges.

Section 16. Dispersion of Radioactive Materials through Groundwater.

(a) Description of the groundwater hydrology of the region shall be developed and data shall be collected on the uses of groundwater in the region.

(b) Program of hydrogeological evaluation shall be carried out to permit the assessment of radionuclide movements in hydrogeological units. This program shall include evaluation of the migration and retention characteristics of the soils, the dilution and dispersion characteristics of the aquifers and the physical and physicochemical properties of underground materials, mainly related to transfer mechanisms of radionuclides in ground water and their exposure pathways.

(c) Assessment of the potential impact of the contamination of groundwater on the population shall be performed by using the data and information collected in a suitable model.

(d) The evaluation shall determine the following:
   (1) The estimated concentration of radioactive material in groundwater at the nearest point in the region where ground water is drawn for human consumption;
   (2) Radionuclide retention characteristic of the soil;
   (3) The transport paths and travel times for radioactive material to reach the source of consumption from the point of release;
   (4) The transport capacity of the surface flow, interflow and groundwater discharge;
   (5) The susceptibility to contamination of the aquifers at different levels; and
   (6) Time and space distributions of the concentrations in the groundwater of radioactive material resulting from accidental releases from the nuclear installation.

Section 17. Population Density and Distribution.

(a) The distribution of the population within the region shall be determined.

(b) In particular, information on existing and projected population distributions in the region, including resident populations and to the extent possible transient populations, shall be collected and kept up to date over the lifetime of the nuclear installation. Special attention shall be paid to the population living in the immediate vicinity of the nuclear installation, to densely populated areas and population centers in the region, and to residential institutions such as schools, hospitals and prisons.

(c) The most recent census data for the region, or information obtained by extrapolation of the most recent census data, shall be used in obtaining the population distribution. In the absence of reliable data, a special study shall be carried out.

(d) The data shall be analysed to give the population distribution in terms of the direction and distance from the installation. An evaluation shall be performed

of the potential radiological impacts of normal discharges and accidental releases of radioactive material including reasonable consideration of releases due to severe accidents, with the use of site specific parameters as appropriate.

Section 18. Uses of Land and Water in the Region.

The uses of land and water shall be characterized in order to assess the potential effects of the nuclear installation in the region and particularly for the purposes of preparing emergency plans. The investigation shall cover land and water bodies that may be used by the population or may serve as a habitat for organisms in the food chain.

Section 19. Ambient Radioactivity.

Before commissioning of the nuclear installation the ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region shall be assessed so as to be able to determine the effects of the installation. The data obtained are intended for use as a baseline in future investigations.

V. MONITORING OF HAZARDS

Section 20. Monitoring of Hazards.

(a) The characteristics of the natural and human induced hazards as well as the demographic meteorological and hydrological conditions shall be monitored over the lifetime of the nuclear installation.

(b) The monitoring shall be commenced no later than the start of construction and shall be continued up until decommissioning.

(c) All the hazards and conditions that are considered in this Part and that are pertinent to the licensing and safe operation of the nuclear installation shall be monitored.

(d) Site specific hazards shall be periodically reviewed using updated knowledge, typically every ten (10) years, and shall be re-evaluated when necessary.

(e) A review after a shorter interval shall be considered in the event of evidence of potentially significant changes in hazards.

(f) The implications of such a review of site specific hazards for the safe operation of the nuclear installation shall be evaluated.

VI. QUALITY ASSURANCE

Section 21. Quality Assurance Program.

The quality assurance programme is a part of the overall management system for the nuclear installation. However, since activities for site investigation are normally initiated long before the establishment of a nuclear project, the quality assurance programme shall be established at the earliest possible time consistent with its application in the conduct of site evaluation activities for the nuclear installation.

(a) As part of the management system programme for the nuclear installation, an adequate quality assurance program shall be established to control the effectiveness of the execution of the site investigations and assessments and engineering activities performed in the different stages of the site evaluation for the nuclear installation.

(b) The program shall cover the organization, planning, work control, personnel qualification and training, verification and documentation for the activities to ensure that the required quality of the work is achieved.

(c) The program shall be implemented for all activities that may influence safety or that may contribute to the derivation of parameters that will ultimately contribute to the design basis for the site may be graded in accordance with the importance to safety of the individual siting activity under consideration.

(d) The results of the activities for site investigation shall be compiled in a report that documents the results of all in situ work, laboratory tests and geotechnical analyses and evaluations.

(e) The results of the studies and investigations shall be documented in sufficient detail to permit an independent review.

(f) Records shall be kept of the work carried out for site evaluation for the nuclear installation during the lifetime of the nuclear installation.

VII. EFFECTIVITY

Section 22. Effective Date.

This Part shall take effect fifteen (15) days following the publication in the Official Gazette or in a newspaper of general circulation.

Approved:

CARLO A. ARCILLA, Ph. D.
Director, PNRI

Date: MAY 03 2019