

NIGERIAN NUCLEAR REGULATORY AUTHORITY

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NIGERIAN NUCLEAR SAFETY REGULATIONS FOR
LICENSING

~~OF SITING ES FOR OF~~ NUCLEAR INSTALLATION
NUCLEAR POWER PLANTS

TABLE OF CONTENTS

PART I: GENERAL

Interpretation	5
Objectives	11
Purpose	11
Scope	12
Application	12

PART II: REQUIREMENTS FOR LICENSING SITES FOR NUCLEAR POWER PLANTS

Installations- Radiation Safety Requirements	12
Authorization Process for Licensing Sites	12
Content of Application	13
Emergency Preparedness and Response Plans	13
Review of Applications by the Authority	14
Consultations with the NSC and NEC	14
Public Hearings	14
Issuance of Site License	14
Duration of License	15
Application for Renewal	15
Criteria for Renewal	15
Use of Site for Other Purposes	16
Finality of Site License Determinations	16
Authority Finality	16
Updating of Site License – Emergency Preparedness	16
Hearings and Petitions	17
Variances	17
Site License Amendment	17

PART III: SAFEGUARD AND SECURITY CONSIDERATIONS

Physical Protection	18
Remote Areas	18
Transportation Routes	18
Socioeconomics	18
Noise	19

PART IV: CRITERIA FOR DETERMINATION OF EXCLUSION AREA BOUNDARY, LOW POPULATION ZONES AND POPULATION DISTANCE AREA

	19
PART V: GENERAL REQUIREMENTS FOR EVALUATION OF SITES	20
Site Investigation	20

PART VI: GENERAL CRITERIA FOR EVALUATION OF SITES

	20
PART VII: EVALUATION OF SEISMIC HAZARDS	22
Scope of Investigation	23
Earthquakes	23
Required Investigation for Vibratory Ground Motion	23

Surface Faulting	24
Instrumentation and Monitoring	24
Extreme values of meteorological phenomena	25
Lightning	26
Rare Meteorological Events	26
Tornadoes	26
Tropical Cyclones	26
Data for Design Purposes	26
Sand Dunes	27
Flooding	27
Floods Due to Precipitation and other Causes	27
Water Waves Induced by Earthquakes or Other Geological Phenomena	28
Floods and Waves Caused by Failure of Water Control Structures	28
PART IX: GEOTECHNICAL HAZARDS	29
Slope Instability	29
Collapse, Subsidence or uplift of Site Surface	29
Soil Liquefaction	29
Behaviour of Foundation Materials	29
Improvement of Foundation Condition	30
Conditions for Improvement of foundation	30
Analysis of Seismic- Soil- Structure Interaction	30
Settlement and Heaves	30
Static Analysis	30
Dynamic Analysis	30
Effects of Induced Vibrations	31
Earth Structures	31
Natural Slopes	31
Dykes and Dams	31
Seawalls, Break Waters and Revetments	31
Buried Structures	31
Retaining Walls	31
Embedded Structures	31
Buried Pipes, Conduits and Tunnels	31
PART X: EXTERNAL HUMAN INDUCED EVENTS	32
Aircraft crashes	32
Chemical explosions	32
Other Important Human Induced Events	32
Ship Collisions	33
PART XI: SITE CHARACTERISTICS AND THE POTENTIAL	
EFFECTS OF <u>NUCLEAR INSTALLATION</u> <u>NUCLEAR POWER PLANT</u> IN THE	
REGION	34
Atmospheric Dispersion of Radioactive Material	34
Dispersion of Radioactive Material through Surface Water	34
Dispersion of Radioactive Material through Groundwater	34
PART XII: OTHER IMPORTANT CONSIDERATIONS	35
Population Distribution	35
Uses of Land and Water in the Region	36
Ambient Radioactivity	36

Monitoring of Hazards	36
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PART XIII: QUALITY ASSURANCE FOR SAFETY IN SITING NUCLEAR INSTALLATION NUCLEAR POWER PLANTS

36

Quality Assurance Programme on management Activities	36
Grading	37
Organization	37
Interfaces	37
Training and Qualification	38
Planning	38
Non-Conformance Control and Corrective Actions	38
Document Control and Records	38
Human Factors	38
Performance	39
Source of Data	39
Data Format	39
Measuring and Testing Equipment	39
Verification	39
Work Planning	39
Procurement	40
Work Control	40
Computer Modelling	40
Physical Modes	41
Collection of Data	41
Reviewing Data, Calculations and Results	41
Output Documentation and Reporting	41
Site Survey	42
Survey Plan	42
Final Survey Report	42
Site Evaluation and Confirmation	43
Field and Laboratory Work	43
Assessment	43
Internal Audits	43
External Audits	43
Surveillance	43
Peer Evaluation	44
PART XIV: OFFENCES AND PENALTIES	44
Offences and Penalties	44
Appeal	44
PART XV: CITATION	44
Citation	44
SCHEDULE	45

NUCLEAR SAFETY AND RADIATION PROTECTION ACT

(1995 No. 19)

NIGERIAN SAFETY REGULATIONS FOR LICENSING OF SITES FOR ~~NUCLEAR INSTALLATION~~ NUCLEAR POWER PLANTS

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act 1995 and of all other powers enabling it in that behalf, the Nigerian Nuclear Regulatory Authority, with the approval of the President, hereby makes the following Regulations -

Commencement: 2010

PART I: - GENERAL

Interpretation

1. For the purpose of these Regulations the meaning of the **terms in bold** are provided below unless the context stipulates otherwise;

absorbed dose	the quotient $\frac{dE}{dm}$ (in Gy) where dE is the mean energy imparted by ionizing radiation to matter in a volume element and dm is the mass of matter in the volume element
accelerometer	an instrument that records the acceleration of the ground during an earthquake
activity	the quotient $\frac{dN}{dt}$ (in Bq or Ci) where dN is the expectation value of the number of spontaneous nuclear transformations from the given energy state in the time interval dt
aggradation	a rise in the level of a river channel or flood plain
ALARA	As Low As Reasonably Achievable social and economic factors taken into cognizance
applicant	“any legal person including their agents who applies to the Authority for authorization to undertake any of the actions covered by the scope of these regulations
approved	approval by the Authority
authority	the Nigerian Nuclear Regulatory Authority established under Section 1 of Act 19 of 1995
authorization	“permission granted in a document by the Authority to a legal person who has submitted an application to carry out a practice within the scope of these regulations. The authorization can take the form of a registration or a license

capable fault	a fault that has a significant potential for relative displacement at or near the ground surface
chronic exposure	exposure persisting in time
collective dose	an expression for the total radiation dose incurred by a population, defined as the product of the number of individuals exposed to a source and their average radiation dose (man.Sv)
<u>critical group</u>	<u>a group of members of the public which is reasonably homogeneous with respect to its exposure for a given radiation source and given exposure pathway and is typical of individuals receiving the highest effective dose or equivalent dose (as applicable) by the given exposure pathway from the given source</u>
decontamination	the removal or reduction of contamination by a physical or chemical process
design basis external events	the external event(s) or combination(s) of external events considered in the design basis of all or any part of a facility
dose limit	“the value of the effective dose or the equivalent dose to individuals from controlled practices that shall not be exceeded
dosimeter	an instrument used for measuring the absorbed dose of radiation
employer	a legal person with recognized responsibility, commitment and duties towards a worker in his or her employment by virtue of a mutually agreed relationship. A self-employed person is regarded as being both an employer and a worker
effective dose	<p>the quantity E, defined as a summation of the tissue equivalent doses, each multiplied by the appropriate tissue weighting factor:</p> $E = \sum_T w_T \cdot H_T$ <p>where H_T is the equivalent dose in tissue T and w_T is the tissue weighting factor for tissue T. From the definition of equivalent dose, it follows that:</p> $E = \sum_T w_T \cdot \sum_R w_R \cdot D_{T,R}$ <p>where w_R is the radiation weighting factor for radiation R and $D_{T,R}$ the average absorbed dose in the organ or tissue T. The unit of effective dose is $J.kg^{-1}$, termed the sievert (Sv)</p>
exclusion area	defined as a parcel of land within or surrounding a nuclear facility on which there is no permanent dwelling and over which the licensee has the legal authority to exercise control
external events	events unconnected with the operation of a facility or

	activity which could have an effect on the safety of the facility or activity
external zone	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
Fault	a tectonic structure along which differential slippage of the adjacent earth materials has occurred parallel to the fracture plane. It is distinct from other types of ground disruptions such as landslides, fissures, and craters. A fault may have gouge or breccia between its two walls and includes any associated monoclin flexure or other similar geologic structural feature;
fission product release	for these calculations should be based upon a major accident, hypothesized for purposes of site analysis or postulated from consideration of possible accidental events that would result in potential hazards not exceeded by those from any accident considered credible. Such accidents have generally been assumed to result in substantial meltdown of the core with subsequent release of appreciable quantities of fission products
hydrologically homogeneous region	a hydrologically homogeneous region is a region for which a hydrological model can be used to transfer hydrological data using the same parameters, systematically varied, as functions of definable space variable characteristics of the region
Ionizing radiation	radiation capable of producing ion pairs in biological materials
interacting event	an event or a sequence of associated events that, interacting with a facility affect site personnel or items important to safety in a manner which could adversely influence safety
isokeraunic maps and data	the average annual days with thunderstorm of the world and a ground flash density map of five years of data
License	an authorization granted by the Authority on the basis of a safety assessment and accompanied by specific requirements and conditions to be complied with by the licensee
licensee	the holder of a current license granted for a site, practice or source who has recognized rights and duties for the practice or source, particularly in relation to protection and safety
limit	the value of a quantity used in certain specified activities or circumstances that must not be exceeded
management	“all activities, administrative or operational, that are involved in the manufacture, supply, receipt, storage, use, transfer, import, export, transport, maintenance or disposal of

	radioactive sources
monitoring	the measurement of dose or contamination for reasons related to the assessment or control of exposure to radiation or radioactive substances, and the interpretation of the results
NiBIRR	Nigeria Basic Ionizing Radiation Regulations, 2003
notification	a document submitted to the Authority by a legal person to notify an intention to carry out a practice or any other action within the scope of these regulations
NPP	an abbreviation for Nuclear Power Plants
occupational exposure	all exposures of workers incurred in the course of their work, with the exception of exposures from practices or sources exempted by the scope of the regulations
operating basis earthquake	that earthquake which, considering the regional and local geology and seismology and specific characteristics of local subsurface material, could reasonably be expected to affect the plant site during the operating life of the plant; it is that earthquake which produces the vibratory ground motion for which those features of the nuclear installation nuclear power plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional
practicable	social, technical, economic factors taken into consideration
practice	any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed
public exposure	exposure incurred by members of the public from radiation sources, excluding any occupational or medical exposure and the normal local natural background radiation but including exposure from authorized sources and practices and from intervention situations
qualified expert	an individual who, by virtue of certification by appropriate boards, societies, professional licensees, academic qualifications and experience, duly recognized as having expertise in any specialized field e.g. medical physics, radiation protection, occupational health, fire safety, quality assurance or any relevant engineering or safety specialty
radiation safety officer	an individual technically competent in radiation protection and safety matters relevant for a given type of practice who is designated by the registrant or licensee to oversee the application of the requirements of the Regulations
radiation source	anything that may cause radiation exposure, such as by

	emitting ionizing radiation or releasing radioactive substances or materials. A complex or multiple installations situated at one location or site may, as appropriate, be considered a single source for the purposes of application of the regulations
radioactive substances	substances that emit ionizing radiation
radioactive waste	a material, whatever its physical form, remaining from practices or interventions and for which no further use is foreseen (i) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level from regulatory requirements, and (ii) exposure to which is not excluded from these regulations
region	a specific area to be studied
regulatory control	any form of control applied to facilities or activities by the Authority for reasons related to radiation protection, safety and security of radioactive sources
response spectrum	a plot of the maximum responses (acceleration, velocity or displacement) of a family of idealized single-degree-of-freedom damped oscillators against natural frequencies (or periods) of the oscillators to a specified vibratory motion input at their supports
risk	a multi-attribute quantity expressing hazard, danger or chance of harmful or injurious consequences associated with actual or potential exposures. It relates to quantities such as the probability that specific deleterious consequences may arise and the magnitude and character of such consequences
safe shutdown earthquake	an earthquake which is based upon an evaluation of the maximum earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material. It is that earthquake which produces the maximum vibratory ground motion for which certain structures, systems and components are designed to remain functional
safety	any measures intended to minimize the likelihood of accidents with radiation sources and, should such an accident occur, to mitigate its consequences
screening distance value (SDV)	means the distance from a facility beyond which, for screening purposes, potential sources of a particular external event can be ignored
screening probability level (SPL)	a value of the annual probability of occurrence of a particular type of event below which, for screening purposes, such an event can be ignored
seiche	the sloshing of a closed body of water from earthquake shaking

seismogenic structures	structures that display earthquake activity or manifest historical surface rupture or effects of palaeoseismicity. Seismogenic structures are those considered likely to generate macro-earthquakes within a period of concern
seismometer	an instrument to detect and record earthquakes
Site	the area within the exclusion zone where the NPP and all associated support structures and systems are located
site area	a geographical area that contains an authorized facility, and within which the management of the authorized facility may directly initiate emergency actions
site evaluation	the analysis of the sources of external events for a site that could give rise to hazards with potential consequences for the safety of a nuclear installation nuclear power plant constructed on that site
site personnel	all persons working in the site area of an authorized facility, either permanently or temporarily
siting	the process of selecting a suitable site for a facility, including appropriate assessment and definition of the related design bases
supplier	any legal person to whom a registrant or licensee delegates duties, totally or partially, in relation to the design, manufacture, production or construction of a source. An importer of a source is considered a supplier of the source
surface faulting	“differential ground displacement at or near the surface caused directly by fault movement and is distinct from non-tectonic types of ground disruptions, such as landslides, fissures, and craters
surges	storm surge is the onshore gush of water associated with a low pressure weather system such as coastal rise in water level caused by wind
stakeholders	a person, group, organization, or system who affects or can be affected by Authority's actions pursuant to these regulations
tectonic structure	a large scale dislocation or distortion within the earth's crust. Its extent is measured in miles: <ul style="list-style-type: none"> (i) the capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures' (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, or

(iii) the integrity of the reactor coolant pressure boundary.

time history	the sequence of values of any time-varying quantity (such as a ground motion measurement) measured at a set of fixed times, also known as time series
tsunami	a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands
turbidites	sea-bottom deposits formed by massive slope failures where rivers have deposited large deltas. These slopes fail in response to earthquake shaking or excessive sedimentation load
whole body dose	of 250 mSv referred to in these regulations corresponds numerically to the once in a lifetime accidental or emergency dose for radiation workers. However, neither its use nor that of the 3000 mSv value for thyroid exposure as set forth in these regulations are intended to imply that these numbers constitute acceptable limits for emergency doses to the public under accident conditions. Rather, this 250 mSv whole body value and the 3000 mSv thyroid value have been set forth as reference values, which can be used in the evaluation of nuclear installation nuclear power plant sites with respect to potential accidents of exceedingly low probability of occurrence, and low risk of public exposure to radiation
zone requiring detailed faulting investigation	a zone within which a nuclear power reactor may not be located unless a detailed investigation of the regional and local geologic and seismic characteristics of the site demonstrates that the need to design for surface faulting has been properly determined

Objectives

2. The objectives of these regulations are:

- a) the establishment of the safety requirements for the elements of a site evaluation for [nuclear installation nuclear power plants](#) so as to characterize fully the site specific conditions pertinent to the safety of [nuclear installation nuclear power plants](#);
- b) the protection of the public and the environment from the radiological consequences of radioactive releases due to incidents, accidents and normal operation of [nuclear installation nuclear power plants](#).

Purpose

3. The purpose is to establish safety 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:

- (i) defining the extent of information on a proposed site to be presented by the applicant;

- (ii) evaluating a proposed site to ensure that the site related phenomena and characteristics are adequately taken into account;
- (iii) analyzing the characteristics of the population of the region and the capability of implementing emergency preparedness and response programmes over the projected lifetime of a [nuclear installationnuclear power plant](#), and
- (iv) defining site related hazards.

Scope

4. The scope of these regulations encompasses site related factors and site-installation interaction factors relating to [nuclear installationnuclear power plants](#) operational states and accident conditions, including those that could lead to emergency measures, natural and human induced events external to the installation that are important to safety. The external human induced events considered in these regulations are all of accidental origin.

5. These Regulations are concerned mainly with severe events of low probability that relate to the siting of [nuclear installationnuclear power plants](#) which have to be considered in designing particular [nuclear installationnuclear power plants](#).

6. The scope of the investigation for the site of a [nuclear installationnuclear power plant](#) covers the entire process of the site evaluation. This consists of the selection, assessment, preoperational and operational stages.

7. These Regulations are primarily concerned with the detailed evaluation of candidate sites to be undertaken by the applicant.

Application

8. (1) The application of these Regulations shall be in addition to the NiBIRR and any other existing ionizing radiation and nuclear regulations in force.

(2) These Regulations shall apply to all applicants desirous of siting and operating civil [nuclear installationnuclear power plants](#) in Nigeria.

Part II: Requirements for Licensing Sites for Nuclear Installations- Radiation Safety Requirements

9. The principal radiation safety requirements related to justification of practice, dose limitation, optimization of protection, and dose constraints, as specified in Nigeria Basic Ionizing Radiation Regulations (NiBIRR), 2003 shall apply to sites for [nuclear installationnuclear power plants](#).

Authorization Process for Licensing of Sites for [Nuclear-InstallationNuclear power plants](#)- Filing of Applications

10. The applicant for a licence to site a [nuclear installationnuclear power plant](#) shall file an application for authorization with the Authority in the form as may be prescribed by the Authority.

11. Licensing procedure for [nuclear installationnuclear power plant](#)(s) in Nigeria shall comprise of the following stages:

- i. Licensing of Site
- ii. Licensing of Design and Construction
- iii. Licensing of Commissioning
- iv. Licensing of the Operation, and
- v. Licensing of Decommissioning

12. The applicant shall submit different applications for each stage in regulation 11 which applications shall comply with the applicable filing requirements as may be laid down by the Authority.

13. (1) The fees associated with the filing and review of an application for the issuance of a site licence shall be as determined by the Authority and as provided in the fees schedule.

(2) The Authority may review its fees from time to time without prior notification of applicants

Content of Application

14. The application shall contain all the following information:

(1). Site Safety Analysis Report (SAR), which shall include:

- a) specific number, type, and thermal power level of the facilities, or range of possible facilities, for which the site may be used;
- b) anticipated maximum levels of radiological and thermal effluents from each facility;
- c) type of cooling systems, intakes, and outflows that may be associated with each facility;
- d) boundaries of the site;
- e) proposed general location of each facility on the site;
- f) seismic, meteorological, hydrologic, and geologic characteristics of the proposed site with proper consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time of gathering the historical data;
- g) location and description of nearby industrial, military, or transportation facilities and routes;
- h) existing and projected future population profile of the area surrounding the site;
- i) description and safety assessment of the site on which a facility is to be located. The assessment must contain an analysis and evaluation of the major structures, systems, and components of the facility that bear significantly on the acceptability of the site under the radiological consequence evaluation factors;
- j) information demonstrating that site characteristics are such that adequate security plans and measures can be developed;
- k) The quality assurance/ quality control programme for the ~~nuclear installation~~[nuclear power plant](#);
- l) complete environmental impact assessment report, environmental management system and land use pattern duly approved by the competent regulatory body or bodies;
- m) detailed description of the physical characteristics of the proposed site that could pose a significant barrier to the development of emergency preparedness and response plans.

Emergency Preparedness and Response Plans

(2). The SAR shall also include:

- a) emergency preparedness and response plans stating its proposed major features for review and approval by the Authority in consultation with the Nuclear Security Committee (NSC) and the Nuclear Emergency Committee (NEC);
- b) emergency preparedness and response plans submitted under paragraph 2 (a) above shall include the proposed inspections, tests, and analyses that the applicant shall perform, and the

acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility when constructed shall be operated in conformity with the emergency preparedness and response plans, the provisions of the Act, and the Authority's regulations;

- c) description of contacts and arrangements made with Federal, State, and Local governmental agencies with emergency planning responsibilities;
- d) any certifications that have been obtained;
- e) where these certifications cannot be obtained, the Site SAR must contain information, including a utility plan, sufficient to show that the proposed plans provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at the site, and
- f) under the option set forth in paragraph 4 of this section, the applicant shall submit a written commitment to the Authority from the governmental agencies that:
- g) the proposed emergency preparedness and response plans are practicable;
- h) these agencies are committed to participating in any further development of the plans, including any required field drills, and
- i) that these agencies are committed to executing their responsibilities under the plans in the event of an emergency.

Review of applications by the Authority

15. Applications filed under these regulations shall be reviewed according to the ~~applicable standards~~ Standard Review Plan of as may be set by the Authority.

Consultation with NSC and NEC

16. The Authority shall determine, after consultation with the NSC and NEC that:
- (i) there is no significant impediment to the development of emergency preparedness and response plans that cannot be mitigated or eliminated by measures proposed by the applicant;
 - (ii) the major features of emergency preparedness and response plans submitted by the applicant are acceptable to the Authority and in accordance with National Nuclear and Radiological Emergency Response Plan, and
 - (iii) the emergency preparedness and response plans submitted by the applicant provide reasonable assurance that adequate protective measures can and shall be taken in the event of a radiological emergency.

Public Hearings

17. The Authority shall upon review of an application:

- (i) notify relevant Federal Agencies, State and Local Governments;
- (ii) notify other bordering States and stakeholders in the area where the ~~nuclear installation~~ nuclear power plant shall be sited of the application, and
- (iii) organize public hearings.

18. The procedure in regulation ~~17.8~~ shall be applied provided that the sections shall not be construed to require that the environmental report, or draft or final environmental impact statement include an assessment of the benefits of construction and operation of the ~~nuclear installation~~ nuclear power plants, or an analysis of alternative energy sources.

19. During the public hearings for site license, the Authority shall not admit contentions proffered by any party concerning an assessment of the benefits of construction and operation of the installations, or an analysis of alternative energy sources if these were not addressed by the applicant in the early site application.

Issuance of Site license

20. After conducting public hearings, the Authority may issue a site license, in the form the Authority deems appropriate, if the Authority finds that:

- (i) an application for a site license meets the applicable standards and requirements of the Act and the Regulations
- (ii) notifications, if any, to other agencies or bodies have been duly made
- (iii) it is sufficiently assured that the site is in conformity with the provisions of the Act, and Regulations
- (iv) the applicant is technically qualified to engage in the activities authorized
- (v) the proposed inspections, tests, analyses and acceptance criteria, including any on emergency planning, are necessary and sufficient, within the scope of the site license, to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Act and the regulations
- (vi) issuance of the license will not be inimical to the common defence and security or to the health and safety of the public; and
- (vii) any resulting adverse environmental impact from activities requested can be redressed.

21. The site license shall specify the site characteristics, design parameters, and terms and conditions of the license as specified by the Authority.

22. Before issuance of a construction license referencing a site license, the Authority shall ensure that all relevant terms and conditions of the site license have been met.

23. Any terms or conditions of the site license that could not be met by the time of issuance of the construction license must be set forth as terms or conditions of the construction license.

Duration of License

24. Except as otherwise provided in these regulations, a site license issued under these regulations shall be valid for a period of 10 years from the date of issuance;

25. A site license continues to be valid beyond the date of expiration in any proceeding on a construction license application that references the site license and received before the date of expiration of the site license, or, if a timely application for renewal of the license has been received, before the Authority has determined whether to renew the license.

26. The applicant for a construction license may, at his/her own risk, reference in his application a site for which a site license application has been received but not granted.

27. Upon issuance of a construction license a referenced site license is subsumed, to the extent referenced, into the construction license.

Application for Renewal

28. An application for renewal of a site license shall be submitted to the Authority not less than 12 or more than 24 months before its expiration.

29. An application for renewal must contain all information necessary to bring up to date the information and data contained in the previous application.

30. Any person whose interests may be affected by the renewal of the license may request the Authority in writing for a hearing on the application for renewal.

31. A site license, either original or renewed, for which a timely application for renewal has been filed, remains in effect until the Authority has determined whether or not to renew the license.

Criteria for Renewal

32. The Authority shall grant the renewal if it determines that the site complies with the Act, the regulations and orders applicable and in effect at the time the site license was originally issued.

33. The Authority shall impose additional requirements that:

- (i) are necessary for adequate public protection and of common defence and security;
- (ii) are necessary for compliance with regulations and orders applicable and in effect at the time the site license was originally issued; or
- (iii) a substantial increase in overall public protection and safety of common defence and security to be derived from the new requirements, and the direct and indirect costs of implementation of those requirements are justified in view of this increased protection.

34. A denial of renewal for failure to comply with the provisions of these regulations does not bar the licensee or another applicant from filing a new application for the site which proposes changes to the site or the way that it is used to correct the deficiencies cited in the denial of the renewal.

Use of Site for Other Purposes

35. A site for which a site license has been issued under these regulations may be used for purposes other than those described in the license, including the location of other types of energy facilities subject to the approval of the Authority.

36. The information about the activities shall be given to the Authority at least 6 months in advance of any actual construction or site modification for the activities.

37. Where an application is made to locate other types of energy facilities the Authority may impose additional requirements on the license.

Finality of Site License Determinations

Authority Finality

38. Notwithstanding any provision in these regulations, while a site license is in effect the Authority may not change or impose new site characteristics, design parameters, or terms and conditions, including emergency planning requirements, on the site license unless the Authority:

- (i) determines that a modification is necessary to bring the license or the site into compliance with regulations and orders applicable and in effect at the time the license was issued;
- (ii) determines the modification is necessary to assure adequate public protection and common defence and security.

39. In making the findings required for issuance of a construction license or in any enforcement hearing other than one initiated by the Authority, if the application for the construction license references a site license, the Authority shall treat as resolved those matters resolved in the proceedings on the application for issuance or renewal of the site license:

- (i) if the site license approved an emergency plan or major features thereof that is in use by a licensee of a ~~nuclear installation~~nuclear power plant, the Authority shall treat as resolved changes to the site license emergency plan (or major features thereof) that are identical to changes made to the licensee's emergency preparedness and response plans occurring after issuance of the site license;
- (ii) if the site license approved an emergency plan or major features thereof that are not in use by a licensee of a ~~nuclear installation~~nuclear power plant, the Authority shall treat as resolved changes that are equivalent to those that could be made without prior Authority's approval had the emergency plan been in use by a licensee.

Updating of Site License - Emergency Preparedness

40. The applicant for a construction or operating license who has filed an application referencing a site license issued under these regulations shall update the emergency preparedness information that was earlier provided and discuss whether the updated information materially changes the basis for compliance with relevant requirements

Hearings and Petitions

41. In any proceeding for the issuance of a construction or operating license referencing a site license, contentions on the following matters may be litigated in the same manner as other issues material to the proceeding:

- (i) the ~~nuclear installation~~nuclear power plant proposed to be built does not fit within one or more of the site characteristics or design parameters included in the site license;
- (ii) one or more of the terms and conditions of the site license have not been met;
- (iii) new or additional information is provided in the application that substantially alters the basis for a previous conclusion or constitutes a sufficient basis for the Authority to modify or impose new terms and conditions related to emergency preparedness; or
- (iv) any significant environmental issue that was not resolved in the site license proceedings, or any issue involving the impacts of construction and operation of the facility that was resolved in the site license proceedings for which significant new information has been identified.

42. Any person may file a petition to the Authority requesting that the site characteristics, design parameters, or terms and conditions of the site license be modified, or that the license be suspended or revoked.

43. The Authority on receipt of the petition shall notify the applicant and grant both parties such time not exceeding three months to address the issues raised in the petition

44. Before construction commences, the Authority shall consider the petition and determine whether any immediate action is required. If the petition is granted, an appropriate order will be issued.

45. Construction under the construction license will not be affected by the granting of the petition unless the order is made immediately effective.

Variances

46. The applicant for a construction or operating license referencing a site license may include in his/her application a request for a variance from one or more site characteristics, design parameters, or terms and conditions of the site license, or from the site SAR.

47. In determining whether to grant the variance, the Authority shall apply the same technically relevant criteria applicable to the application for the original or renewed site license.

48. Once a construction license referencing a site license is issued, variances from the site license will not be granted for that construction license.

Site License Amendment

49. The holder of a site license shall not make changes to the site license, including the site SAR, without prior approval of the Authority.

50. The request for a change to the site licence must be in the form of an application for a license amendment.

Part III: Safeguard and Security Considerations

51. The applicant for a site ~~installation~~ license under these Regulations shall protect Safeguards Information against unauthorized disclosure.

52. The applicant shall:

(1) provide a vulnerability assessment report of the site from the Office of the National Security Adviser

(2) develop and submit to the Authority security-related physical protection measures for nuclear ~~power plant installation~~ including gathering information about the nuclear ~~power plant installation~~ proposed siting location

53. The findings from this study shall be presented by the applicant in a **Site Selection Threat Assessment (SSTA)** report.

Physical Protection

54. The applicant shall ensure that in the proposed physical protection requirements appropriate ~~defection detection~~, delay, ~~detection~~, and response considerations are taken into account.

Remote Areas

55. For remote sites the applicant shall establish a comprehensive on-site nuclear response force capability.

Transportation Routes

56. The ~~following~~ transportation routes in the vicinity of the site shall be considered and evaluated.:

- ~~(i) Availability of a standard gauge railway line between the site and the nearest seaport, and~~
- ~~—Availability of high grade dual carriage way~~
- ~~(ii) Availability of inland waterways~~

Socioeconomics

57. The applicant shall ensure that:

- (i) An evaluation of the suitability of ~~nuclear installation~~nuclear power plant sites near distinctive communities shall demonstrate that the construction and operation of the ~~nuclear installation~~nuclear power plant, including transmission and transportation corridors, and potential problems relating to community services, such as schools, police and fire protection, water and

sewage, and health facilities, will not adversely affect the distinctive character of the community nor the populations

- (ii) A preliminary investigation shall be made to address environmental justice considerations and to identify and analyze problems that may arise from the proximity of a distinctive community to a proposed site
- (iii) Evaluation of the suitability of a site shall include consideration of purpose and probable adequacy of socioeconomic impact mitigation plans for such economic impacts on any community
- (iv) Siting decisions shall reflect fair treatment and meaningful involvement of all people, regardless of race, ethnicity, culture, income or educational level to assure equitable consideration and to minimize disproportionate effects on different groups of the populations.

Noise

58. The applicant shall ensure that noise levels at proposed sites must comply with applicable Federal, State, and local noise regulations.

Part IV - Criteria for Determination of Exclusion Area Boundary, Low Population Zones and Population Centre Distance

59. As an aid in evaluating a proposed site, a fission product release from the core, the expected demonstrable leak rate from the containment and the meteorological conditions pertinent to the site shall be assumed to derive an exclusion area, a low population zone and population centre distance. For the purpose of this analysis, which shall set forth the basis for the numerical values used, the applicant shall determine the following:

- (i) An exclusion area of such size that an individual located at any point on its boundary for two hours immediately following onset of the postulated fission product release would not receive a total radiation dose to the whole body in excess of 250 mSv or a total radiation dose in excess of 3000 mSv to the thyroid from iodine exposure;
- (ii) A low population zone of such size that an individual located at any point on its outer boundary who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage) would not receive a total radiation dose to the whole body in excess of 250 mSv or a total radiation dose in excess of 3000 mSv to the thyroid from iodine exposure;
- (iii) A population centre distance of at least one and one-third times the distance from the installation to the outer boundary of the low population zone. For this purpose, the boundary of the population centre shall be determined upon consideration of population distribution.

60. For sites of multiple ~~nuclear installation~~nuclear power plants, the applicant shall consider:

- (i) if the installations are independent to the extent that an accident in one plant would not initiate an accident in another, the size of the exclusion area, low population zone and population centre distance shall be fulfilled with respect to each plant individually, the envelopes of the plan overlay of the areas so calculated shall then be taken as their respective boundaries;
- (ii) if the installations are interconnected to the extent that an accident in one plant could affect the safety of operation of any other, the size of the exclusion area, low population zone and population centre distance shall be based upon the assumption that all interconnected installations emit their postulated fission product releases simultaneously;

- (iii) This requirement may be reduced in relation to the degree of coupling between installations, the probability of concomitant accidents and the probability that an individual would not be exposed to the radiation effects from simultaneous releases. However, the basis for such a reduction in the source term shall be justified to the satisfaction of the Authority;
- (iv) the applicant is expected to show that the simultaneous operation of multiple reactors at a site will not result in total radioactive effluent releases beyond the allowable limits as prescribed by the Authority

Part V- General Requirements for Evaluation of Sites

Site Investigation

61. The programme of investigation to be undertaken by the applicant shall cater for all stages of site evaluation process. The site evaluation process shall involve the following stages:

- (i) Selection Stage
- (ii) Characterization Stage
- (iii) Pre-Operational Stage
- (iv) Operational Stage

62. In the evaluation of the suitability of a site for a ~~nuclear installation~~nuclear power plant, the applicant shall consider the following aspects:

- (i) the effects of external events occurring in the region of the particular site and hazardous phenomena associated with human events initiated by sources external to the plant;
- (ii) the characteristics of the site and its environs that could influence the transfer to persons and the environment of radioactive material that has been released through either dispersion in air, soil or water;
- (iii) evaluation of seismic hazards for the ~~nuclear installation~~nuclear power plant through the determination of ground motion hazards and the potential for surface faulting which could affect the feasibility of construction and safe operation of the plant;
- (iv) hazards assessment of extreme and rare meteorological phenomena that could influence the release of radiation;
- (v) evaluation of the flood hazard so as to enable the identification of hazardous phenomena associated with flooding events;
- (vi) the geotechnical engineering aspects relevant for the safety of ~~nuclear installation~~nuclear power plant;
- (vii) 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.

63. If the site evaluation of all the aspects cited in regulation 62 indicates that the site is unsuitable and the deficiencies cannot be compensated for by means of design features, measures for site protection or administrative procedures, the applicant shall deem the site as unsuitable.

Part VI: General Criteria for Evaluation of Sites

64. (1) The applicant shall investigate and assess:

- (i) site characteristics that may affect the safety of the ~~nuclear installation~~nuclear power plant;
- (ii) characteristics of the natural environment in the region that may be affected by potential radiological impacts in operational states and accident conditions

(2) The applicant shall ensure that all these characteristics are observed and monitored periodically as may be determined by the Authority throughout the lifetime of the installation.

65. The applicant shall examine proposed sites for ~~nuclear installation~~nuclear power plants with regard to the frequency and severity of external natural and human induced events and phenomena that could affect the safety of the installations.

66. The applicant shall evaluate the foreseeable evolution of natural and human made factors in the region that may have a bearing on safety for a time period that encompasses the projected lifetime of the ~~nuclear installation~~nuclear power plant. These factors, particularly population growth and distribution, shall be monitored over the lifetime of the installation

67. The hazards associated with external events that are to be considered in the design of the ~~nuclear installation~~nuclear power plant shall be determined by the applicant.

68. Additional matters relating to safety during storage and transport of input and output materials (Uranium ore, UF₆, UO₂, etc.), fresh and spent fuel and radioactive wastes shall be considered in determining the suitability of the site by the applicant.

69. The applicant shall, in the site evaluation process, take into account the non-radiological impact of the installation, due to chemical or thermal releases, and the potential for explosion and the dispersion of chemical products.

70. The applicant shall consider the interactions between nuclear and non-nuclear effluents.

71. The applicant shall evaluate for each proposed site the potential radiological impacts in operational states and in accident conditions on people in the region that could lead to emergency measures with due consideration of the following:

- (i) population distribution;
- (ii) dietary habits;
- (iii) use of land and water;
- (iv) radiological impacts of any other releases of radioactive material in the region.

72. The applicant shall investigate proposed sites with regard to all the site characteristics that could be significant to safety in external natural and human induced events.

73. The applicant shall identify and evaluate possible natural phenomena and human induced situations and activities in the region of a proposed site.

74. The applicant shall consider foreseeable changes in land use including the expansion of existing installations and human activities or the construction of high risk installations in site selection.

75. The applicant shall collect and analyze for reliability, accuracy and completeness pre-historical, historical and instrumentally recorded information and records, as applicable, of the occurrences and severity of important natural phenomena or human induced situations and activities.

76. The applicant shall adopt appropriate methods for establishing the hazards that are associated with major external phenomena.

77. The applicant shall ensure that the size of the region to which a method for establishing the hazards associated with major external phenomena is to be applied shall be large enough to include all the features and areas that could be of significance in the determination of the natural and human induced phenomena under consideration and for the characteristics of the event.

78. In the evaluation of a site to determine its potential radiological impact on the region for operational states and accident conditions that could lead to emergency measures, the applicant shall make appropriate estimates of expected or potential releases of radioactive material, with account taken of the design of the installation and its safety features. These estimates shall be confirmed when the design and its safety features have been confirmed.

79. The direct and indirect pathways by which radioactive material released from the ~~nuclear installation~~[nuclear power plant](#) could potentially reach and affect people and the environment shall be identified and evaluated by the applicant.

80. The applicant shall examine the site and the design for the ~~nuclear installation~~[nuclear power plant](#) together to ensure that the radiological risk to the public and the environment associated with radioactive releases is acceptably low.

~~81. The applicant shall consider foreseeable changes in land use including the expansion of existing installations and human activities or the construction of high risk installations in site selection.~~

82. The applicant shall study the proposed region to evaluate the present and foreseeable future characteristics and the distribution of the population of the region.

83. The applicant shall ensure that in relation to the characteristics and distribution of the population, the combined effects of the site and the installation shall be such that:

- (i) for operational states of the installation the radiological exposure of the population shall comply with the provisions of NiBIRR with account taken of international recommendations;
- (ii) the radiological risk to the population associated with accident conditions, including those that could lead to emergency measures being taken, is acceptably low.

84. The external zone for a proposed site shall be established by the applicant with account taken of the potential for radiological consequences for people and the

feasibility of implementing emergency preparedness and response plans, and of any external events or phenomena that may hinder their implementation.

85. Before the commencement of construction of a ~~nuclear installation~~[nuclear power plant](#), the applicant shall confirm that there will be no insurmountable difficulties in establishing an emergency plan for the external zone before the start of operation of the plant.

86. Where the site region extends beyond national borders and, for sites located near a coastline, the applicant shall investigate the relevant onshore/offshore area

Part VII: Evaluation of Seismic Hazards

87. The applicant shall investigate the hazards of ground motion and faulting associated with earthquakes and geological phenomena for every ~~nuclear installation~~[nuclear power plant](#).

88. The applicant shall ensure that the size of the region to be investigated, the type of information to be collected and the scope and detail of the investigations shall be determined according to the nature and complexity of the seismotectonic environment:

- (i) Site area investigations shall include investigations of site effects of the rocks at the site.
- (ii) All recorded earthquake data that have occurred in the region shall be collected and analyzed
- (iii) Strong motion accelerometers/seismometers shall be installed permanently within the site area and maintained so as to operate continuously and record small and large events throughout the life time of the plant.

89. The applicant shall investigate all geologic and seismic factors that may affect the design and operation of the proposed ~~nuclear installation~~[nuclear power plant](#) irrespective of whether such factors are explicitly included in this section.

Scales of Investigation

90. The investigations to be carried out by the applicant shall be on four scale basis, namely:

- (i) **Regional Investigations:** These shall provide general knowledge on the geodynamic setting of the region which identifies and characterizes those geological features that may influence or relate to the seismic hazard at the site. This investigation shall cover a radial extent not less than 300 km.
- (ii) **Near Regional Investigations:** These shall be used to determine the latest movements of faults and for the faults of importance for seismic hazard assessment, the amount and nature of displacements, rates of activity and evidence of segmentation. The investigation shall cover a geographical area with radial extent of not less than 25 km.
- (iii) **Site Vicinity Investigations:** These investigations shall be employed to define in greater detail the neotectonic history of faults, especially in determining the potential for surface faulting at the site and to identify conditions of potential geological instability of the site area. It shall cover a geographical area of not less than 5 km in radius.
- (iv) **Site area investigations:** These investigations shall be employed to obtain detailed knowledge of the potential for permanent ground displacement and to provide information on the dynamical properties of foundation materials to be

used in site response analysis. This investigation shall include the entire area covered by the plant, which shall not be less than a square kilometre.

Earthquakes

91. The seismological and geological conditions in the region and the engineering geological aspects and geotechnical aspects of the proposed site area shall be evaluated by the applicant.

92. Information on pre-historical, historical and instrumentally recorded earthquakes in the region shall be collected and documented by the applicant.

93. The applicant shall ensure that the hazards associated with earthquakes are determined by means of seismotectonic evaluation of the region with the use to the greatest possible extent of the information collected.

94. Hazards due to earthquake induced ground motion shall be assessed for the site by the applicant 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.

Required Investigation for Vibratory Ground Motion

95. The applicant shall conduct investigations to obtain information needed to describe the vibratory ground motion produced by the Safe Shutdown Earthquake. The investigations shall include:

- (i) determination of the lithologic, stratigraphic, hydrologic, and structural geologic conditions, including the geologic history of the site and the region surrounding it
- (ii) identification and evaluation of tectonic structures underlying the site and the region surrounding the site, whether buried or exposed.
- (iii) evaluation of physical evidence concerning the behaviour during prior earthquakes of the surficial geologic materials and the substrata underlying the site from the lithologic, stratigraphic, and structural geologic studies.
- (iv) determination of static and dynamic engineering properties of the materials underlying the site
- (v) establishment of the Safe Shutdown Earthquake for capable faults within 300 square kilometres of the site which may be of significance as shown in Schedule 1.

Operating Basis Earthquake

The Operating Basis Earthquake shall be specified by the applicant after considering the seismology and geology of the region surrounding the site. If vibratory ground motion exceeding that of the Operating Basis Earthquake occurs, shutdown of the nuclear power plant shall be required. Prior to resuming operations, the licensee shall be required to demonstrate to the Authority that no functional damage has occurred to those features necessary for continued operation without undue risk to the health and safety of the public.

The maximum vibratory ground acceleration of the Operating Basis Earthquake shall be at least one-half the maximum vibratory ground acceleration of the Safe Shutdown Earthquake.

Surface faulting

96. The potential for surface faulting shall be assessed for the site by the applicant. The methods to be used and the investigations to be made shall be sufficiently detailed.

97. The applicant shall consider a fault capable if on the basis of geological, geophysical, geodetic or seismological data, one or more of the following conditions applies:

- (i) it shows evidence of past movement or movements, significant deformations and/or dislocations, of a recurring nature 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;
- (iii) the maximum potential earthquake associated with a 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.

98. Based on regulation 97, where reliable evidence shows the existence of a capable fault that has the potential to affect the safety of the ~~nuclear installation~~nuclear power plant, an alternative site shall be considered by the applicant.

Instrumentation and Monitoring

99. (1) The applicant shall ensure that solid-state digital instrumentation that will enable the processing of data at the installation site within 4 hours of the seismic event shall be used.

(2) The applicant shall ensure that a triaxial time-history accelerometer/seismometer shall be installed permanently at the site throughout the life-time of the installation at the following locations:

- (i) Free-field.
- (ii) Containment foundation.
- (iii) Two elevations (excluding the foundation) on a structure within the containment
- (iv) An independent Seismic Category I structure foundation where the response is different from that of the containment structure.
- (v) An elevation (excluding the foundation) on the independent Seismic Category I structure.

100. The specific locations shall be determined by the ~~nuclear installation~~nuclear power plant designer to obtain the most pertinent information consistent with maintaining occupational radiation exposures ALARA for the location, installation, and maintenance of seismic instrumentation.

101. The applicant shall install a local seismological network which shall be connected to the national seismological network in the site area of the installation.

102. The applicant shall ensure that:

- (i) the seismic instrumentation system are operable and operated at all times;

- (ii) it operate during all modes of plant operation, including periods of plant shutdown;
- (iii) the maintenance and repair procedures provide for keeping the maximum number of instruments in service during plant operation and shutdown.

103. For the confirmation of low seismic activity of the selected site and surrounding areas the applicant shall install seismographic instruments and collect data at the beginning of 2-years-before-the-final site selection

Part VIII: Meteorological Events

104. The applicant shall investigate the:

- (i) extreme values of meteorological variables and rare meteorological phenomena for the site of any nuclear installationnuclear power plant; and
- (ii) the meteorological and climatological characteristics for the region around the site.

Extreme values of meteorological phenomena

105. In order to evaluate their possible extreme values, the following meteorological phenomena shall be documented by the applicant:

- (i) wind;
- (ii) precipitation;
- (iii) snow;
- (iv) temperature;
- (v) storm surges;
- (vi) squall;
- (vii) hail; and
- (viii) dust/sand storms.

106. Evaluation of long term meteorological phenomena and variations in these phenomena shall require a minimum of thirty years data collected continuously from the nearest meteorological observation station by the applicant.

107. On site meteorological data shall require a minimum of two years continuous observation data at each of the candidate sites

108. The output of the site evaluation shall be described by the applicant in a way that is suitable for design purposes for the installation. Uncertainties in the data shall be taken into account in this evaluation.

Lightning:

109. The potential for the occurrence and the frequency and severity of lightning shall be evaluated for the site by the applicant.

110. The applicant shall provide Isokeraunic maps and data for the region.

Rare Meteorological Events

Tornadoes:

111. The potential for the occurrence of tornadoes in the region of interest shall be assessed by the applicant on the basis of detailed historical and instrumentally recorded data for the region.

112. The applicant shall ensure that the hazards associated with tornadoes are derived and expressed in terms of rotational wind speed, translational wind speed, radius of maximum rotational wind speed, pressure differentials and rate of change of pressure parameters.

113. In the assessment of the hazard, missiles that could be associated with tornadoes shall be considered by the applicant.

Tropical Cyclones

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

115. On the basis of the available data and the appropriate physical models, the hazards associated with tropical cyclones shall be determined by the applicant in relation to the site.

116. In the assessment of the hazards, missiles that could be associated with tropical cyclones shall be considered by the applicant.

Data for Design Purposes

117. The applicant shall collect the following data on storm parameters for tropical cyclones:

- (i) minimum central pressure,
- (ii) maximum wind speed,
- (iii) horizontal surface wind profile,
- (iv) shape and size of the eye,
- (v) vertical temperature and humidity profiles within the eye,
- (vi) characteristics of the tropopause over the eye,
- (vii) positions of the tropical cyclone at regular, preferably six hourly, intervals,
- (viii) sea surface temperature.

118. The maximum credible wind speed at the site shall be specified by the applicant.

119. Possible effects of climate evolution and its consequences in relation to the hazards shall be assessed by the applicant throughout the lifetime of the ~~nuclear installation~~nuclear power plant.

Sand Dunes

120. The applicant shall assess and evaluate sites located in desert areas for the accumulation of hazard associated with sand dunes.

Flooding

121. The applicant shall conduct investigation to identify sites vulnerable to:

- (i) coastal flooding; and
- (ii) river flooding

122. The potential for flooding shall be evaluated by the applicant during both the regional analysis of the site selection phase for a ~~nuclear installation~~nuclear power plant, development project and the site assessment phase.

123. All preliminary assessment shall be sufficiently well documented by the applicant to demonstrate either that the plant would not be affected by any potential flooding or that the potential for flooding is insignificant and has a negligible effect on safety.

Floods Due to Precipitation and Other Causes

124. The applicant shall assess the region to determine the potential for flooding due to one or more natural causes resulting from precipitation or snow melt, high tide, storm surge, seiche and wind waves that may affect the safety of the ~~nuclear installation~~nuclear power plant. If there is a potential for flooding, then all pertinent data, including historical data, both meteorological and hydrological, shall be collected and critically examined.

125. The applicant shall establish a program of hydrological/hydrogeological investigations.

126. The applicant shall develop a suitable meteorological and hydrological model 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.

127. The possible combinations of the effects of several causes shall be examined by the applicant. For coastal sites and sites on estuaries, the potential for flooding by a combination of high tide, wind effects on bodies of water and wave actions, shall be assessed and taken into account in the hazard model.

128. The hazards for the site due to flooding shall be derived from the model by the applicant.

129. The parameters used to characterize the hazards due to flooding by the applicant shall include the height of the water, the height and period of the waves the warning time for the flood, the duration of the flood and the flow conditions.

130. The potential for instability of the coastal area or river channel due to erosion or sedimentation shall be investigated by the applicant.

Water Waves Induced by Earthquakes or Other Geological Phenomena

130. The applicant shall:

- (i) evaluate the region to determine the potential for tsunamis or seiches that could affect the safety of a ~~nuclear installation~~nuclear power plant on the site;
- (ii) collect and critically evaluate pre-historical and historical data relating to tsunamis or seiches affecting the shore region around the site for their relevance to the evaluation of the site and their reliability;

131. The applicant shall, on the basis of the available pre-historical and historical data from 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.

132. 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 by the applicant.

133. 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 run-up that may result in physical effects on the site.

Floods and Waves Caused by Failure of Water Control Structures

134. Information relating to upstream water control structures shall be analyzed by the applicant to determine whether the ~~nuclear installation~~nuclear power plant would be able to withstand the effects resulting from the failure of one or more of the upstream structures.

135. If the ~~nuclear installation~~nuclear power plant could safely withstand all the effects of the massive failure of one or more of the upstream structures, then the structures need not be examined any further in this regard.

136. If a preliminary examination of the ~~nuclear installation~~nuclear power plant indicates that it might not be able to withstand safely all the effects of the massive failure of one or more of the upstream structures, then the hazards associated with the ~~nuclear installation~~nuclear power plant shall be assessed with the inclusion of all such effects; otherwise such upstream structures shall be analyzed.

137. The possibility of storage of water as a result of the temporary blockage of rivers upstream or downstream so as to cause flooding and associated phenomena at the proposed site shall be examined by the applicant.

Volcanism

138. The prospective license shall carry out an evaluation of all active volcanism in the region that could affect the safe operation of the NPP; this shall include information on prehistoric, historic, and instrumentally recorded volcanic activity in the region such as burning clouds, ash falls, lava flows and ground shaking. The evaluation shall consider:

- Characteristics of the volcanic source, such as seismic triggers, ash, and volatile gases;
- Potential effects on ventilation systems;
- Missiles that could have an impact on SSCs;
- Potential abrasion or chemical impact on SSCs;
- Effects on air and water intakes;
- Effects of static electricity generation on electrical or electronic SSCs;
- Effects on off-site power supplies to the site; and
- Effects on emergency plan execution.

Slope Instability

138. The site and its vicinity shall be evaluated by the applicant to determine the potential for slope instability that could affect the safety of the [nuclear installationnuclear power plant](#)

139. If a potential for slope instability that could affect the safety of the [nuclear installationnuclear power plant](#) is identified, the hazard shall be evaluated by using parameters and values for the site specific ground motion.

Collapse, Subsidence or Uplift of the Site Surface

140. The applicant shall:

- (i) examine geological maps and other appropriate information for the region for the existence of natural features like caverns, karstic formations and human made features;
- (ii) evaluate the potential for collapse, subsidence or uplift of the site surface;
- (iii) 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 installationnuclear power plant](#), provide practicable engineering solutions or otherwise the site shall be deemed unsuitable
- (iv) if practicable engineering solutions are available, a detailed description of subsurface conditions obtained by reliable methods of investigation shall be developed for the purposes of determination of the hazards.

Soil Liquefaction

141. The applicant shall, for soils susceptible to liquefaction, source and investigate the information on the design profile that is needed to evaluate the liquefaction potential.

142. The potential for liquefaction of the subsurface materials of the proposed site shall be evaluated by the applicant using parameters and values for site specific ground motion

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

144. 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.

Behaviour of Foundation Materials

145. The applicant shall conduct preliminary foundation work for the site.

146. The geotechnical characteristics of the subsurface materials, including the uncertainties in them, shall be investigated and a soil profile for the site in a form suitable for design purposes shall be determined by the applicant.

147. The stability of the foundation material under static and seismic loading shall be assessed by the applicant.

148. The groundwater regime and the chemical properties of the groundwater shall be studied by the applicant.

Improvement of Foundation Condition

Conditions for Improvement of Foundation

149. The applicant shall carry out improvement of foundation condition if:

- (i) The foundation material is not capable of carrying the building loads without unacceptable deformation (settlements)
- (ii) There are cavities that can lead to subsidence
- (iii) There are heterogeneities on the scale of the building size that can lead to tilting and/or unacceptable differential settlements.

150. The applicant shall, when improvement of the foundation condition is required, perform the following tasks:

- (i) determination of the existing in-situ profile;
- (ii) determination of the required profile for foundation material;
- (iii) selection of particular technology by which improvements in the foundation can be made over excavation and compacted backfill, rock removal, densification by various methods, solidification by cement or permanent dewatering;
- (iv) carrying out prototype testing programme to verify experimentally the methods proposed to improve the subsurface conditions;
- (v) preparation of the specification for field operations after the proposed technology has been verified;
- (vi) carrying out an investigation to determine whether the specifications were met at the completion of the improvement programme; and
- (vii) incorporation of any improvement in foundation material into the design profiles used in the assessments.

Analysis of Seismic- Soil- Structure Interaction

151. The applicant shall ensure that a complete analysis of seismic-soil-structure interaction includes:

- (i) Site response analysis
- (ii) Foundation scattering analysis
- (iii) Foundation Impedance analysis
- (iv) Structural modelling
- (v) Analysis of the coupled system interaction response.

Settlement and Heaves

Static Analysis

152. An assessment of settlement under static loads shall be performed by the applicant. The possibility of differential settlements or heaves between the buildings of a ~~nuclear installation~~nuclear power plant shall be investigated because of the presence of pipes, conduits and tunnels providing connections between the facilities.

153. Short term and long term settlements occurring during the operating lifetime of the plant shall be estimated by the applicant.

Dynamic Analysis

154. The applicant shall compute time-dependence by applying the classical theory of consolidation and other sophisticated non-linear analyses. In saturated soils, the following three components shall be considered:

- (i) Settlement without drainage due to shear for fully saturated soils.
- (ii) Settlement caused by consolidation.
- (iii) Settlement caused by creep.

155. The applicant shall ensure that if no structure-soil-structure interaction analysis was carried out, a soil- structure interaction analysis be performed building by building and the individual displacements of the building shall be combined to obtain the dynamic part of the differential displacement. Both horizontal and vertical components shall be considered.

156. For soft soil sites, the residual settlement after earthquake shall be assessed by the applicant by the best available means.

Effects of Induced Vibrations

157. Foundations for structures subjected to vibrations or with vibration loads shall be designed to ensure that vibrations would not cause excessive settlement. For this purpose, precautions shall be taken by the applicant to ensure that resonance would not occur between the frequency of the pulsating load and a critical frequency in the foundation-ground system.

Earth Structures

Natural Slopes

158. The applicant shall:

- (i) investigate natural slopes surrounding the ~~nuclear installation~~[nuclear power plant](#) with regard to the safety of the installation; and
- (ii) consider the external effects of earthquakes and heavy rain falls in the safety evaluation for assessing the potential hazards of natural slopes.

Dykes and Dams

159. The applicant shall ensure that:

- (i) surveillance monitoring of dams and dykes and maintenance work shall be permanently carried out during construction and operation to prevent possible damage such as internal erosion of dykes;
- (ii) permeability is monitored throughout the operating lifetime of the plant.

Seawalls, Break Waters and Revetments

160. The applicant shall ensure that structures are properly designed to prevent soil erosion, flooding and structural failures which may jeopardize the safety of important facilities.

Buried Structures

Retaining Walls

161. The applicant shall ensure that active pressures of the earth due to earthquake are evaluated by means of considering an artificial gravity inclined in the unfavourable direction. The vertical component of the seismic acceleration shall also be considered as acting upward or downward.

162. The passive pressure of the earth shall also be considered by the applicant. Failure modes that involve sliding surfaces as well as the failure modes that involve the retaining capacity of the wall shall be addressed.

163. The applicant shall ensure that soil behind the foundation shall not be susceptible to liquefaction under SL-2 earthquake conditions.

Embedded Structures

164. The possible cracking of concrete and the need to limit the stress in reinforced bars and concrete shall be taken into account by the applicant in the design of the foundation and special attention shall be paid to the design of the construction joints of buildings.

Buried Pipes, Conduits and Tunnels

165. The layout of buried pipes or conduits shall be considered by the applicant in the site investigation programme.

166. The applicant shall ensure that an assessment of the potential effects of any corrosive environmental agent on the piping material shall be included in the site investigation programme.

Part X: External Human Induced Events

167. External human induced events that could affect safety shall be investigated by the applicant in the site evaluation stage for every [nuclear installation](#)[nuclear power plant](#) site.

168. The region shall be examined by the applicant for facilities and human activities that have the potential, under certain conditions, to endanger the [nuclear installation](#)[nuclear power plant](#) in its lifetime.

169. The applicant shall address public acceptance issues in the site evaluation stage.

Aircraft crashes

170. The applicant shall:

- (i) Assess the potential for aircraft crashes on the site taking into account the characteristics of future air traffic and aircraft;
- (ii) 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](#)[nuclear power plant](#), then an assessment of the hazards shall be made;
- (iii) Ensure that the hazards associated with an aircraft crash to be considered shall include impact, fire and explosions;
- (iv) If the assessment indicates that the hazards are unacceptable and if no practicable solutions are available, then the site shall be deemed unsuitable.

Chemical Explosions

171. The applicant shall ensure that:

- (i) 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 or detonation are identified;
- (ii) Hazards associated with chemical explosions shall be expressed in terms of overpressure and toxicity taking into account the effect of distance;
- (iii) A site shall be considered unsuitable if such activities take place in its vicinity and there are no practicable solutions available.

Other Important Human Induced Events

172. The region shall be investigated by the applicant for installations in which flammable, explosive, asphyxiant, toxic, corrosive or radioactive materials are stored, processed, transported and otherwise dealt with that, if released under normal or accident conditions could jeopardize the safety of the ~~nuclear installation~~nuclear power plant

173. The applicant shall ensure that the investigation in regulation 172.3 shall also include installations that may give rise to missiles of any type that could affect the safety of the ~~nuclear installation~~nuclear power plant

174. 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 by the applicant.

175. If the effects of such phenomena and occurrences would produce an unacceptable hazard and if no practicable solution is available, the site shall be deemed unsuitable by the applicant.

176. The applicant shall ensure that shipping lanes near the site are identified.

177. Railway rolling stock and road traffic, together with their loads shall be identified by the applicant for busy routes, junctions, marshalling yards and loading areas.

178. In examining the adequacy of a site in respect of external human induced events, the applicant shall ensure that attention is also be given to future human activities currently in the planning stage, such as land with potential for commercial development. Such activities in the future may lead to an increased risk of radiological consequences or to sources of interacting events which do not exceed the screening probability level but may grow to reach that level.

179. A survey shall be made by the applicant at and around the site to identify potential sources of fire, such as forests, peat, storage areas for low volatility flammable materials (especially hydrocarbon storage tanks), wood or plastics, factories that produce or store such materials, their transport lines, and vegetation.

180. The applicant shall ensure that the area to be examined for the possible occurrence of fires that may affect items important to safety shall have a radius equal to the SDV for this type of hazard (This radius is some 1 - 2 km from the ~~nuclear installation~~nuclear power plant).

181. Attention shall be paid by the applicant to sources causing possible common mode failures.

182. Parameters and properties that define the magnitude of a fire are:

- (i) maximum heat flux;
- (ii) magnitude of hazards from burning fragments and smoke;
- (iii) duration of the fire.

Ship Collision

183. If the ship collision probability is found to be greater than the SPL, a detailed analysis shall be conducted by the applicant to assess the consequences of such an impact. Parameters to be analyzed shall include:

- (i) impact velocity;
- (ii) impact area;
- (iii) mass and stiffness of the ship;
- (iv) substances transported;
- (v) potential secondary effects such as oil spills and explosions.

Part XI: Site Characteristics and the Potential Effects of the Nuclear Power Plant Installation in the Region

Atmospheric Dispersion of Radioactive Material

184. A meteorological description of the region shall be developed by the applicant, including descriptions of the basic meteorological parameters, regional orography, wind speed and direction, air temperature, precipitation, humidity, atmospheric stability parameters, and prolonged inversions.

185. A programme for meteorological measurements shall be prepared and carried out by the applicant 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 shall be collected, together with any other relevant data that may be available from other sources.

186. The atmospheric dispersion of radioactive material released shall be assessed by the applicant on the basis of the data obtained from the investigation of the region using appropriate models. These models shall include all significant site specific and regional topographic features and characteristics of the ~~nuclear installation~~ nuclear power plant that may affect atmospheric dispersion.

Dispersion of Radioactive Material through Surface Water

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

188. A programme of investigation and measurements of the surface hydrology shall be carried out by the applicant to determine 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.

189. An assessment of the potential impact of the contamination of surface water on the population shall be performed by the applicant by using the collected data and information in a suitable model.

Dispersion of Radioactive Material through Groundwater

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

191. The applicant shall carry out a programme of hydrogeological investigations to permit the assessment of radionuclide movement in hydrogeological units. This programme shall include investigations 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 groundwater and their exposure pathways.

192. An assessment of the potential impact of the contamination of groundwater on the population shall be performed by the applicant by using the data and information collected in a suitable model.

Part XII: Other Important Considerations

193. Historical data concerning phenomena that have the potential to give rise to adverse effects on the safety of the ~~nuclear installation~~[nuclear power plant](#), such as volcanism, sand storms, severe precipitation, snow, ice, hail, and subsurface freezing of sub-cooled water, shall be collected and assessed by the applicant.

194. If the potential is confirmed, the hazard shall be assessed and design bases for these events shall be derived by the applicant.

195. In the design of systems for long term heat removal from the core, the following site related parameters shall be considered by the applicant:

- (i) Air temperature and humidity;
- (ii) Water temperatures;
- (iii) Available flow of water, minimum water level and the period of time for which safety related sources of cooling water are at a minimum level, with account taken of the potential for failure of water control structures.

196. The applicant shall identify potential natural and human induced events that could cause a loss of function of systems required for the long term removal of heat from the core. These may include the blockage or diversion of a river, the depletion of a reservoir, an excessive amount of marine organisms, the blockage of a reservoir or cooling tower by freezing or the formation of ice, ship collisions, oil spills and fires. If the probabilities and consequences of such events cannot be reduced to acceptable levels, then the hazards for the ~~nuclear installation~~[nuclear power plant](#) associated with such events shall be established.

197. If the hazards for the ~~nuclear installation~~[nuclear power plant](#) are unacceptable and no practicable solution is available, the site shall be deemed unsuitable by the Authority.

Population Distribution

198. The distribution of the population within the region shall be determined by the applicant.

199. The applicant shall collect and keep up to date over the lifetime of the ~~nuclear installation~~[nuclear power plant](#) information on existing and projected population distributions in the region, including resident populations and transient populations.

200. The applicant shall pay special attention to the population living in the immediate vicinity of the ~~nuclear installation~~nuclear power plant, to densely populated areas and population centres in the region, and to residential institutions.

201. The most recent census data for the region, or information obtained by extrapolation of the most recent census data shall be used by the applicant in obtaining the population distribution, otherwise, a special study shall be carried out.

202. The data shall be analyzed by the applicant 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.

Uses of Land and Water in the Region

203. The uses of land and water shall be characterized by the applicant in order to assess the potential effects of the ~~nuclear installation~~nuclear power plant in the region and particularly for the purposes of preparing emergency preparedness and response 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.

Ambient Radioactivity

204. Before commissioning of the ~~nuclear installation~~nuclear power plant the ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region shall be assessed by the applicant 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.

Monitoring of Hazards

205. The characteristics of the natural and human induced hazards as well as the demographic, meteorological and hydrological conditions of relevance to the ~~nuclear installation~~nuclear power plant shall be monitored by the applicant over the lifetime of the ~~nuclear installation~~nuclear power plant. This monitoring shall be carried out from the start of construction up to decommissioning.

206. The applicant shall ensure that all the hazards and conditions considered in these regulations and pertinent to the licensing and safe operation of the ~~nuclear installation~~nuclear power plant are monitored.

Part XIII: Quality Assurance for Safety in Siting ~~Nuclear Installation~~Nuclear power plants

207. The applicant shall establish a Quality Assurance programme (QA) as part of the management programme for all ~~nuclear installation~~nuclear power plant stages (siting, design, construction, commissioning, operation and decommissioning).

208. The requirements and needs of the QA programme for a particular stage shall be considered by the applicant during earlier stages so that they are fully established prior to the commencement of the stage.

Quality Assurance Programme on Management Activities

209. The siting process generally consists of the following:

- (i) site survey,
- (ii) site evaluation, and
- (iii) site confirmation.

210. The applicant shall define procedures for controlling siting activities. Arrangements shall be made to ensure that these procedures are reviewed and approved before issuance and subsequent amendments are controlled.

211. The applicant may delegate and/or require suppliers or other organizational units to develop and implement all or part of the QA programme, but shall retain overall responsibility for its implementation and effectiveness.

Grading

212. The applicant shall ensure that nuclear safety shall be the fundamental consideration in the identification of the items, services and processes to which the QA programme applies. A graded approach based on the relative importance to nuclear safety of each item, service or process shall be used. The graded approach shall reflect a planned and recognized difference in the applications of specific QA requirements.

213. The grading process shall consider the following:

- (i) the intended end use of the knowledge and data that resulted from siting activities, particularly in terms of their effect on nuclear safety;
- (ii) the ability to demonstrate, test or repeat results;
- (iii) the scale and technical complexity of the siting activity, if a new or proven concept or model that is being applied, or an extension of a new application;
- (iv) the managerial complexity of the activity, the involvement and coordination of multiple disciplines, work units or internal and external organizations, with divided or contingent objectives and responsibilities;
- (v) the extent to which other siting work, or later work, depends on the results of the siting activities;
- (vi) the expectations or desired use or application of the results.

Organization

214. The applicant shall:

- (i) formally appoint a person, to be known as the "Project Manager for siting", on its staff to be responsible for siting activities;
- (ii) the Project Manager for siting shall be the head of the siting organization;

215. The applicant shall ensure that the Project Manager for siting have the necessary resources within the siting organization to do the following:

- (i) ensure implementation of an effective QA programme
- (ii) ensure siting work is carried out in accordance with requirements, procedures and instructions, including the implementation of specified requirements
- (iii) ensure that siting work undertaken, including work by service organizations, is done in accordance with planned programmes of work.

Interfaces

216. The applicant shall develop an organizational chart showing the parties involved, the interfaces between them and the lines of reporting and communication.

217. The applicant shall ensure that interface arrangements are agreed upon between him/her and other organizational units performing the work. They shall be defined in writing and shall be included in procurement documents where appropriate indicating:

- (i) the responsible organization
- (ii) consultants and various specialists
- (iii) laboratories
- (iv) the principal designer
- (v) the regulatory body
- (vi) local authorities

Training and Qualification

218. The applicant shall ensure that personnel are well trained and qualified to perform their assigned work and understand the safety consequences of their activities.

Planning

219. The applicant shall ensure that siting activities are planned and should define the:

- (i) Siting activities to be performed in manageable units (work breakdown structure).
- (ii) Planned sequential order and duration of these activities.
- (iii) Resource allocation for each activity.

220. The applicant shall retain responsibility for coordinating and planning the overall siting activities; suppliers shall be responsible for producing detailed plans of the work that they will be carrying out and for obtaining the siting organization's approval of these plans where necessary.

221. The applicant shall ensure that planning take into account requirements for studies, evaluations and analyses relative to site survey, site evaluation and site confirmation, and their safety importance for:

- (i) the identification, preparation and control of procedures and work instructions,
- (ii) special equipment, software or materials,
- (iii) competent personnel.

Non-Conformance Control and Corrective Actions

222. The applicant shall establish a non-conformance control and corrective actions process that defines how the following are to be dealt with:

- (i) errors in data, data collection, recording or reporting; calculations, reasoning, assumption and conclusions; software coding and measuring,
- (ii) non-conformance with procedures and specifications.

223. Procedures and specifications shall be made available by the applicant before the start of work on the gathering and analysis of data.

Document Control and Records

224. Procedures for the preparation, review, approval, issuance, modification and control of documents shall be established by the applicant.

225. A records system shall be established by the applicant which shall include the arrangements and responsibilities for the categorization, receipt, indexing, storage, retrieval and disposal of siting records.

226. Sufficient records shall be prepared and retained by the applicant during siting work to enable the process to be repeated if necessary. Records shall support final conclusions and permit tracing of results to source data and information. Permanent records for siting activities shall be identified.

227. The applicant shall ensure that all records and data prepared pursuant to regulation 226 are retrievable and protected from loss or damage.

Human Factors

228. The applicant shall ensure that suitable working environments are provided and maintained so that work can be carried out safely and satisfactorily without imposing unnecessary physical and psychological stress on the siting personnel.

Performance

Sources of Data

229. The data that shall be collected during site survey, site evaluation and site confirmation shall be specified by the applicant.

Data Format

230. The format and standards to be used for collecting, classifying and presenting the data shall be decided and the decisions documented by the applicant.

231. The applicant shall ensure that tests, samples and field data shall be identifiable in field logs and in other relevant reports. The work project number, sample number and type, and the location and date of sampling shall be included.

Measuring and Testing Equipment

232. The applicant shall ensure that measuring and test equipment which is used for siting activities, data collection, inspections and tests shall be of the proper type, range, accuracy and precision and be in good condition.

Verification

233. The applicant shall ensure that work performed during siting shall be verified. The type and extent of verification activity shall be specified.

234. The verification planning shall identify the activity to be verified and shall include:

- (i) the extent of verification
- (ii) the verifier, i.e. a peer, a review committee or a third party
- (iii) the method of verification and the reporting requirements
- (iv) the point in the work cycle where the verification is to be performed.

235. Documents which form part of, or support, siting decisions shall be reviewed by the applicant to confirm that they are correct and satisfactory, and are complete as to assumptions, support data and conclusions.

236. Calculations shall be verified by the applicant by alternative analyses and the analyses, assumptions, initial conditions, boundary conditions and results documented.

237. For field and laboratory activities, appropriate verifications shall be specified by the applicant.

Work Planning

238. The applicant shall ensure that siting activities are organized and performed in such a way that relevant information will be found, collected and scrutinized.

239. The siting activities shall be planned by the applicant to ensure that:

- (i) data are adequate and are recorded correctly;
- (ii) analytical techniques, equipment and instructions are used correctly;
- (iii) data are correctly interpreted;
- (iv) computer programs are adequate and are used correctly;
- (v) samples are collected, handled, shipped and stored properly;
- (vi) samples are correctly and adequately identified;
- (vii) technicians and operators of instruments or equipment are adequately trained.

240. The applicant shall ensure that the test programme documents include:

- (i) the tests or experiments to be performed and their general sequence,
- (ii) the objectives of the tests or experiments,
- (iii) the testing criteria,
- (iv) the reporting requirements.

Procurement

241. The applicant shall ensure that procured services meet established requirements.

242. The applicant shall ensure that procurement activities conform to the regulatory requirements and as applicable, to the provisions of recognized codes, standards and specifications used in the design, manufacture, installation and operation of items and services.

243. The applicant shall ensure that nuclear safety shall be the fundamental consideration in the identification of the items, services and processes to which the QA programme applies.

244. The applicant shall ensure that:

- (i) a graded approach based on the relative importance to nuclear safety of each item, service or process shall be used by the applicant; and
- (ii) the graded approach is applied throughout the supply chain.

Work Control

245. The applicant shall ensure that:

- (i) siting activities, including those associated with compiling, gathering and analyzing the data and reporting conclusions and recommendations are controlled to ensure the results and the supporting documentation such as maps, drawings, photographs, calculations, field notes and historical information are traceable to their sources;

- (ii) documents containing data which have been interpreted, analyzed or validated, experimental results, results from field measurements or tests, and other formal documents which are produced during the data gathering and data analyses are independently reviewed and checked;
- (iii) conclusions are adequately documented to permit traceability to original input requirements, and to make it possible to study information, experimental data, field measurements, and models and their interpretation.

Computer Modelling

246. The applicant shall ensure that the QA programme is applied to the design, testing, application and change control of quantitative models used in siting.

247. Models shall be developed by the applicant in accordance with technically sound methods and practices and shall accurately reflect the acquired data and appropriately represent the system or subsystems.

248. The data used for developing the models shall be protected by the applicant against loss, theft, damage or destruction, and shall be traceable to their source.

249. A sensitivity analysis shall be performed by the applicant to assess the potential uncertainties resulting from the use of the model, especially the more sophisticated models.

Physical Models

250. The applicant shall mainly use physical laboratory models to test hydrodynamic and aerodynamic processes. These models shall be validated and justified.

251. The limitations of the model shall be determined and specified by the applicant.

Collection of Data

252. Data shall be acquired by the applicant according to technically sound methods and practices, to ensure that they are protected against loss, damage or destruction, are traceable to source and are readily retrievable.

253. The availability, precision, nature and scope of data to be collected by the applicant shall be compatible with the methods and models in which they will be used.

Reviewing Data, Calculations and Results

254. The applicant shall ensure that:

- (i) Collected data are checked for accuracy, applicability and completeness.
- (ii) Checks are also be performed to ensure that the data have been accurately transcribed.

255. The applicant shall ensure that critical reviews of reports, analyses, calculations and other output documents shall be carried out by a Review Committee comprised of persons who were not involved in performing the work and the reports of these reviews shall be submitted to him/her.

256. The Review Committee shall include the Project Manager for siting and specialists in the discipline to be reviewed.

Output Documentation and Reporting:

257. Data, analyses, calculations, tests and reviews, proposals, recommendations, conclusions and decisions regarding siting shall be recorded to allow for evaluation.

258. Where not all the information necessary to finalize conclusions is available, such limitations shall be identified by the applicant.

259. The applicant shall ensure that output documents discuss the identified input requirements.

260. The applicant shall ensure that reports describing the intermediate and final results in different areas of investigation, and an analysis of them, shall be prepared and transmitted to the appropriate management. The reports shall describe:

- (i) the relationship of the results to previously known information, tests or theories;
- (ii) a description of the data gathering activities;
- (iii) a description of significant problems that occurred during data gathering activities,
- (iv) studies, analyses and testing;
- (v) a summary of the work, including considerations, conclusions and recommendations.

261. Field reports shall cover all results and observations and shall include:

- (i) the applicable procedure or instruction used
- (ii) all pertinent data and notes
- (iii) data, results and observations in the form specified (for example tables, curves, narrative)
- (iv) discussion of significant conditions encountered, errors introduced and the accuracy of results.

262. Laboratory reports shall also include the identification of activity or test done, equipment used, sample tested, date of the test, and procedure used.

Site Survey

263. A site survey shall be carried out by the applicant to identify one or more sites that would probably be suitable for detailed characterization later in the siting process.

264. The applicant shall ensure that prior to site survey a preliminary report shall be written, reviewed and approved and the report shall be used by the survey team members as a reference for writing each individual interim report at the completion of each phase.

Survey Plan

265. The applicant shall ensure that a site survey plan is developed and shall include amongst others:

- (i) the procedure to be used for the site survey and the proposed separation into phases, for example regional analysis, screening, comparison and ranking;
- (ii) the site characteristics to be considered;
- (iii) the data required (the type and degree of comprehensiveness);
- (iv) all possible sources of required data;
- (v) the approach (parallel or serial) to be used for collecting data;
- (vi) provisions for checking and reviewing results and calculations;
- (vii) provisions for collecting information from sources known only to local experts;
- (viii) the identification and description of the tasks to be performed;
- (ix) diagrams showing the sequence of the various tasks; the methods and criteria to be used for performing regional analyses and for screening, comparison and ranking;

- (x) an outline of procedures for applying these criteria and a list of sources of information needed for their application;
- (xi) key events and requirements for interim reporting after each identified phase.

Final Survey Report

266. The applicant shall ensure that the final survey report shall be comprehensive and clear as to its intent and its conclusions. The final survey report shall contain the complete results and their analysis. It shall contain amongst others:

- (i) a clear presentation of the data, the procedures and considerations and recommendations;
- (ii) limitations or uncertainties of the data, analyses, computer programs and procedures;
- (iii) a complete description of the region studied;
- (iv) a comparison of the sites investigated;
- (v) the reasons for rejecting unacceptable sites;
- (vi) the preferred candidate sites.

Site Evaluation and Confirmation

267. The applicant shall ensure that:

- (i) During the site evaluation, all of the sites selected during the survey phase are studied in sufficient detail.
- (ii) During the site confirmation the characteristics of the site chosen shall be completed and monitored.
- (iii) The collection of data shall continue throughout the construction stage and shall be required during operation.

Field and Laboratory Work

268. The applicant shall ensure that:

- (i) Checks of the surveying activities are conducted during the work to ensure satisfactory performance. Records of survey activities shall be maintained;
- (ii) When unusual circumstances are encountered, they shall be recorded and reported. Adequate checks shall be specified and conducted while the work is in progress to ensure that work is performed according to requirements;
- (iii) During the performance of fieldwork, controls shall be implemented to ensure:
 - a) location of a measurement or of an item such as a geological feature is accurately recorded
 - b) type and number of borings, excavations, geophysical and geological surveys, and samplings of soil, rock ground, water and air are identified
 - c) proper sample handling, storage and shipping methods are used to prevent disturbance or changes in properties or in data
 - d) similarly, during laboratory work, the preservation of sample integrity and identification shall be maintained.

Assessment

269. The applicant shall ensure that:

- (i) Performance indicators shall be developed to measure whether performance is satisfactory or not, with particular emphasis on safety;
- (ii) Managers shall ensure that all personnel performing assessment activities, including themselves, have appropriate qualification, training and experience. An independent assessment shall be conducted.

Internal Audits

270. The applicant shall ensure that a system for internal audits shall be established by the assessment unit and agreed with the management of the organization.

External Audits

271. External audits of suppliers shall be managed by assessment unit for management

Surveillance

272. A programme of surveillance of work performance shall be established by the applicant.

Peer evaluation

273. The applicant shall ensure that a programme of peer evaluation is established and shall consist of experts in all areas of evaluation.

274. The following are to be addressed by independent assessment during siting:

- (i) Interfaces;
- (ii) work planning for field activities;
- (iii) methods for handling errors and non-conformances;
- (iv) traceability of data;
- (v) specifications for data format, work instructions, field samples and output documents;
- (vi) selection and monitoring of special service organizations;
- (vii) conduct of field and laboratory work.

PART XIV- OFFENCES AND PENALTIES

Offences and Penalties

275. (1) Any person who contravenes any of the provisions of these regulations commits an offence.

(2) Any person who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority.

(3) The Authority shall impose penalties such as suspension, revocation of authorization, imposing administrative fine, closure (Sealing) of facility or any combination of these.

(4) Any person or corporate body who, being a holder of authorization under these regulations, commits an offence shall be liable to prosecution in the court of law and upon conviction be liable to pay fines not exceeding N5, 000, 000 for an individual and not exceeding N50, 000, 000 for a corporate body or be given a jail term not exceeding ten years or both.

Appeal

276. Any person to whom these regulations apply may appeal to the Board of the Authority if he/she is not satisfied with the decision made against him/her.

PART XV- CITATION

Citation

277. These regulations may be cited as the Nigerian Safety Regulations for Licensing of Sites for ~~Nuclear Installation~~[Nuclear power plants](#).

SCHEDULE 1

For guidance in determining which faults may be of significance in determining the Safe Shutdown Earthquake, Schedule 1 below presents the minimum length of fault to be considered versus distance from site. Capable faults of lesser length than those indicated in the Table and faults which are not capable faults need not be considered in determining the Safe Shutdown Earthquake, except where unusual circumstances indicate such consideration is appropriate:

Schedule 1: Distance from the site versus minimum length of fault (Km) which shall be considered in establishing Safe Shutdown Earthquake

Distance from the site (kilometre):	Minimum length of fault (kilometre) considered in establishing Safe Shutdown Earthquake
0 to 32	1.6
Greater than 32 to 80	8.0
Greater than 80 to 160	16
Greater than 160 to 240	32
Greater than 240 to 320	64

- (2) Determination of the following parameters for such capable faults:
- a. the length of the fault,
 - b. the relationship of the fault to regional tectonic structures, and
 - c. the nature, amount, and geologic history of displacements along the fault, including the estimated amount of the maximum Quaternary displacement related to any one earthquake along the fault.