

## **Part I. LEGAL DOCUMENTS**

### **THE MINISTRIES**

#### **THE MINISTRY OF SCIENCE AND TECHNOLOGY**

### **Circular No. 28/2011/TT-BKHHCN of October 28, 2011, stipulating nuclear safety requirements for nuclear power plant sites**

*Pursuant to the June 3, 2008 Law on Atomic  
Energy:*

*Pursuant to the Government's Decree No.  
70/2010/ND-CP of June 22, 2010, detailing  
and guiding a number of articles of the Law on  
Atomic Energy regarding nuclear power plants;*

*Pursuant to the Government's Decree No.  
28/2008/ND-CP of March 14, 2008, defining  
the functions, tasks, powers and organizational  
structure of the Ministry of Science and  
Technology;*

*The Minister of Science and Technology  
stipulates nuclear safety requirements for  
nuclear power plant sites as follows:*

#### Chapter I

#### GENERAL PROVISIONS

##### **Article 1.** Scope of regulation

This Circular stipulates nuclear safety requirements, survey and evaluation of nuclear

power plant (NPP) sites to serve their approval.

##### **Article 2.** Subjects of application

This Circular applies to investors and agencies and organizations involved in the survey, evaluation, appraisal and approval of NPP sites, and to related consultancy organizations.

##### **Article 3.** Interpretation of terms

In this Circular, the terms below are construed as follows:

1. Design basis means a range of naturally occurring or artificial conditions, processes and factors, which are taken explicitly into account in the design of a nuclear power plant, such that plant can withstand them without exceeding authorized limits by designed operation of the safety system.

2. Unfavorable condition means a naturally occurring or artificial condition, process or factor which is likely to cause an incident to an NPP.

3. Active fault means a tectonic fracture which is likely to cause surface or subsurface shear.

4. Karst means a range of geologic processes and phenomena taking place on ground surface or underground principally due to the chemical dissolution of soluble soil and rock, forming caverns and destructing and deforming the soil and rock structure and state, groundwater mechanism, topographic features and

hydrological network mechanism.

5. Design basis incident means a naturally occurring or artificial condition, process or factor which is likely to cause an incident postulated in a design.

## Chapter 2

### GENERAL REQUIREMENTS ON NUCLEAR SAFETY OF NPP SITES

#### Article 4. Principles for site evaluation

1. A site is evaluated to be suitable to the building of a NPP if satisfying all the following conditions:

a/ Being capable of assuring safety for the NPP in normal operation conditions as well as upon the occurrence of a design basis incident;

b/ Being capable of preventing humans and the environment from being hazardously affected by radiation from the NPP in normal operation conditions as well as upon the occurrence of a design basis incident;

c/ Mitigating hazards to humans and the environment upon the occurrence of an accident exceeding the design basis level (below referred to as beyond design basis accident).

2. Upon site evaluation, the following factors and characteristics must be adequately surveyed and studied:

a/ Naturally occurring and artificial factors which might cause offsite impacts on the safety of the NPP;

b/ Features of the site and environment related to the dispersion of radioactivity from the NPP which is hazardous to humans and the environment;

c/ Population density and distribution and regional characteristics related to the execution of incident response measures.

3. In case the evaluation under Clause 2 of this Article shows that a site has any of the following characteristics, such site shall be disapproved:

a/ Having an active fault;

b/ Being possibly subject to ground vibration caused by an earthquake with a peak ground acceleration (PGA) of a value of at least 360 cm/s<sup>2</sup>, with a repetitive cycle of 10,000 years;

c/ Having a developing karst or a karst creating a ground surface crater of a diameter of over 20 m.

4. In case the evaluation under Clause 2 of this Article shows that a site has, in addition to the characteristics specified in Clause 3 of this Article, other unfavorable conditions which cannot be remedied with design measures, safeguards or administrative regulations, such site shall be disapproved.

#### Article 5. Site survey and study

1. The survey and study of features of a site and related factors and the identification of their hazards shall be conducted under the following provisions:

a/ To survey and study features of the site

which might impact the safety of the NPP, including earthquake, surface fault, volcano, hydrological conditions, flood and inundation, tsunami, geo-technical conditions and factors caused by human activities, and cooling water and power supply sources for the NPP;

b/ To collect prehistoric and historic data and recorded measurement data on times of occurrence and severity of natural phenomena and events significant to the safety evaluation of the site. In seismic, meteorological and hydrological fields, there must be recorded measurement data of the last five years up to the date of filing a dossier of request for site approval, including data of at least 12 months which are continuously recorded and reliable, accurate and complete;

c/ To forecast the change of features which might impact the safety of the NPP for a period at least equal to the projected lifetime of the NPP;

d/ To survey and study the frequency and identify the severity of hazards of naturally occurring and artificial factors which might impact the safety of the NPP;

e/ To use appropriate methods to identify the severity of hazards of naturally occurring and artificial factors which might impact the safety of the NPP. Used methods must be modern and proven as appropriate to the features of the surveyed and evaluated site;

f/ To use site-specific data in identifying the severity of hazards. In case it is impossible to collect site-specific data, data on another site with features proven as equivalent to those of

the site of the NPP concerned may be used;

g/ When surveying and studying the features specified at Point a of this Clause, to choose parameters and parameter values appropriate to the identification of the severity of hazards for designing the NPP;

h/ To prove that the area surveyed and studied for identification of the severity of hazards of naturally occurring and artificial factors is large enough for embracing all features significant for the identification of the severity of hazards of phenomena and events and appropriate to used specific methods.

2. When survey and study are conducted for selecting and evaluating a site, Vietnam standards must be applied. For fields in which Vietnam standards are unavailable, insufficient or inconsistent, foreign standards may be applied if permitted by competent agencies.

3. Survey and study activities and results shall be recorded in files for archive and submission to competent state agencies when requesting approval of an NPP site.

#### Article 6. Impacts of NPPs

1. To survey and study environmental factors which impact the dispersion of radioactivity from an NPP, covering radioactivity dispersion in the atmosphere, surface water and groundwater. The area of the surveyed and studied site depends on the radioactivity dispersion in case of normal operation of the NPP as well as in case of an incident.

2. To identify the possibility of radioactive

impacts on humans and the environment based on the basic design and radioactive fallout dispersed in case of normal operation of the NPP as well as in case of an incident to be responded.

3. To identify and evaluate the routes of direct and indirect dispersion of radioactivity from the NPP and the area in which humans and the environment might be affected. The identification and evaluation shall be conducted on the basis of features of the site, paying attention to those of the biosphere related to the accumulation and transportation of radioactive cores.

4. To evaluate the site in relation with the basic design of the NPP. The evaluation must generate sufficient grounds for making a conclusion that the irradiation dose caused by the plant on radiation staff and the public is limited at the lowest reasonably obtainable level within the limit prescribed by law.

**Article 7.** Population features and incident response plans

1. To study and evaluate population features and distribution at present and in the future in the area likely to be affected by radioactivity dispersed from an NPP. The study and evaluation must cover the evaluation of use of soil and water and lie within the relation with peculiar features related to the level of dispersed radioactivity hazardous to humans.

2. To study and evaluate the capability to establish an incident response area surrounding

an NPP site based on results of the study and evaluation specified in Clause 1 of this Article and features related to the implementation of this plan, assuring that the irradiation dose caused by the plant on the public does not exceed the limit prescribed by law.

**Article 8.** Observation for safety assurance

The observation of factors and features of a site related to the assurance of safety for an NPP, humans and the environment shall be conducted throughout the lifetime of the plant, and covers also the observation of population growth and distribution.

**Article 9.** Assurance of quality and examination and inspection of survey, study and data collection

1. When conducting survey, study and data collection for site evaluation, investors and related agencies and organizations shall:

a/ Formulate and implement quality assurance programs, paying special attention to activities which might impact the safety and the identification of parameters to serve as the design basis;

b/ Send plans on conduct of survey, study and data collection related to nuclear safety requirements for NPP sites to the radiation and nuclear safety authority.

2. The radiation and nuclear safety authority shall examine and inspect surveys, studies and collection of documents related to nuclear safety requirements for NPP sites under law.

Chapter 3

SURVEY AND EVALUATION OF  
NATURAL CONDITIONS AND HUMAN  
ACTIVITIES RELATED TO NPP SITES

**Article 10.** Earthquakes, surface faults and volcanoes

1. To evaluate the severity of hazards of ground vibrations caused by earthquakes to sites, taking into account seismic-tectonic characteristics and special conditions of the ground. To analyze the reliability of evaluation results.

2. To study and evaluate evidence of active faults and activity of volcanoes and the severity of their hazards to the safety of NPPs. The evaluation must involve survey and study methods and jobs detailed enough for making reasonable decisions.

**Article 11.** Meteorology

1. To survey and study meteorological parameters and extreme meteorological phenomena, including lightning, tornado, typhoon and other meteorological phenomena in localities, which might impact the safety of NPPs.

2. Survey and study results must be adequate and suitable to purposes of designing NPPs, covering also the probability of occurrence of extreme meteorological phenomena with parameters exceeding design parameters.

**Article 12.** Floods and inundation

To evaluate the possibility of floods or inundation in NPP sites as follows:

1. To identify causes of floods or inundation attributable to one or several natural phenomena, including heavy rains, flood tide, tidal wave, sea wave, flood and other phenomena. In case a flood or inundation is likely to occur and impact the safety of an NPP, necessary meteorological and hydrological data, including also historic data, must be collected, observed and analyzed. For historic data, to consider their relevance and reliability for the site evaluation.

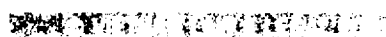
2. To analyze data relevant to the structure of the upstream water source-regulating system, which possibly contributes to causing a flood.

3. To build appropriate meteorological and hydrological models, taking into account limitations on the accuracy and volume of data and duration of data collection, and past changes of relevant features of the area.

**Article 13.** Tsunamis

1. To generally evaluate related areas for determining the possibility of occurrence of tsunamis impacting the safety of NPPs. In case of possibility of a tsunami to occur and impact the safety of an NPP, to collect, record, measure and analyze necessary seismic and seismic-tectonic data, including also prehistoric and historic data. For prehistoric and historic data, to consider their relevance and reliability for the site evaluation.

2. Based on collected data and comparison



of evaluated areas with other areas with similar features in which tsunami has been adequately studied, to evaluate the frequency of occurrence, destructive power and height of tsunamis for identifying the severity of their hazards, taking into account coast characteristics which magnify these hazards.

3. To build appropriate tsunami impact models, taking into account limitations on the accuracy and volume of data and duration of data collection, and evaluate possible impacts on the safety of NPPs in different scenarios.

**Article 14.** Geo-technical factors

1. To evaluate the possibility of slope instability and soil and rock erosion affecting the safety of NPPs. In case slope instability is possible, to identify the severity of its hazards, using parameters and values of the peculiar ground vibration of areas.

2. To evaluate the possibility of surface uplift, collapse or subsidence of sites caused by naturally occurring or artificial factors such as cavern, karst formation, mining pit, water or oil well, based on appropriate geologic maps and data.

3. To evaluate the possibility of liquefaction of the ground at sites based on ground vibration parameters and values. To use appropriate soil and rock survey and analysis methods to identify the severity of hazards of ground liquefaction to NPPs.

4. To survey and study geo-technical characteristics of the ground, regime and

chemical properties of groundwater. To identify and describe soil and rock layers at sites in forms appropriate to design purposes. To evaluate the stability of foundations under impacts of static and seismic loads.

**Article 15.** Factors caused by human activities

1. To evaluate the possibility of aircraft crashes at NPP sites and the severity of their hazards, taking into account the frequency of flights and characteristics of present and future aircraft. In case an aircraft crash is possible at a site, to identify the severity of its hazards to the NPP.

2. To identify activities in areas related to the disposal, storing and transportation of chemicals which are likely to cause a violent outburst or generate flammable or explosive gases. To identify the severity of hazards caused by chemical explosion, including also impacts caused by pressure or toxicity, taking into account the distance to the site.

**Article 16.** Cooling water and power supply sources for NPPs

1. To evaluate site parameters relating to the supply of cooling water for NPPs, including:

a/ Air temperature and humidity;

b/ Water temperature;

c/ Water sources with data on flow currents, the lowest water reserve, time periods during which water is retained at the lowest water reserve, taking into account the possible damage of the water-regulating structure.

2. To identify the reason for reduction or change of characteristics of cooling water sources supplied to NPPs caused by natural or human activities such as change or blocking of river currents, draining of reservoirs, generation of an extremely large volume of sediments or marine organisms, oil spill or fire.

3. To identify power sources supplied for structures, systems and components important to the safety of NPPs.

#### Chapter 4

#### SURVEY AND EVALUATION OF POSSIBILITY OF DISPERSION OF RADIOACTIVITY FROM NPPs WHICH CAN IMPACT THE PUBLIC

**Article 17.** Radioactivity dispersion in the atmosphere

1. To survey and study meteorological and related factors, including topographical and such basic meteorological phenomena and parameters as heavy rainfall, humidity, wind speed and direction and air temperature, stability and disturbance.

2. To implement programs on meteorological observation at sites and related areas to serve the evaluation of radioactivity dispersion in the atmosphere. To use observation equipment capable of recording and measuring meteorological parameters at appropriate heights and positions. The location of observation areas and installation of observation equipment depend on topographical and meteorological characteristics. In addition to

observation data, meteorological data currently available in other sources must be collected.

3. To evaluate the radioactivity dispersion in the atmosphere based on collected data and appropriate dispersion models. A dispersion model must take into account topographical characteristics of the site and related areas which affect the radioactivity dispersion in the atmosphere and characteristics of NPPs shown in the basic design.

**Article 18.** Radioactivity dispersion in surface water

1. To survey and study characteristics of surface water in areas related to the possibility of radioactivity dispersion in surface water, including natural and artificial water sources, main structures used for controlling water sources, positions for installing water-intaking structures and use of surface water sources in these areas.

2. To implement programs on survey and study of surface water for identifying the dilution and dispersion of water sources, possibility of sediments and organisms to accumulate, mechanism of transmission of radioactive cores in the hydrosphere and routes of radiation exposure.

3. To evaluate the possibility of radioactively contaminated surface water to affect the population based on collected data and appropriate dispersion models.

**Article 19.** Radioactivity dispersion in groundwater

1. To survey and study characteristics of groundwater in areas relating to the possibility of radioactivity dispersion in groundwater, including characteristics of water sources, their interaction with surface water and the use of groundwater in these areas.

2. To implement programs on survey, study and analysis of properties of groundwater to evaluate the mechanism of transmission of radioactive cores. These programs must cover the survey and study of characteristics of soil and water, physical and physico-chemical properties of materials in soil relating to the mechanism of accumulation and transmission of radioactive cores in groundwater and routes of radiation exposure.

3. To evaluate the possibility of radioactively contaminated groundwater to affect the population based on collected data and appropriate dispersion models.

**Article 20.** Population distribution and radiation background

1. To identify data on population distribution based on the latest census and extrapolation so as to acquire present and future data on areas in which inhabitants might be affected by radioactivity dispersion. If reliable data are insufficient, additional survey and study shall be conducted. Data shall be analyzed to identify the population distribution in different directions and at different distances to NPPs. To evaluate the possibility of radioactivity to affect the population in normal radioactive emission conditions and in case of an incident,

including a major accident, taking into account typical parameters of the site.

2. To evaluate the radiation background in the atmosphere, hydrosphere, lithosphere and biota in the areas for use as a basis for identifying radiation impacts of the NPPs in the future.

**Article 21.** Limits of irradiation dose on the public

A selected site must ensure that:

1. In case of normal operation of the NPP, the irradiation dose caused by the plant on the public does not exceed the limit prescribed by law.

2. In case of an incident, the incident response plan can be executed to keep the irradiation dose caused by the plant on the public below the limit prescribed by law.

## Chapter 5

### IMPLEMENTATION PROVISIONS

**Article 22.** Effect

1. This Circular takes effect on December 15, 2011.

2. Any problems arising in the course of implementation should be promptly reported by agencies, organizations and individuals to the Ministry of Science and Technology for consideration, amendment and supplementation.-

*For the Minister of  
Science and Technology*  
Deputy Minister  
LE DINH TIEN