Approved by
Order No. 26 of the Federal Environmental, Industrial and Nuclear Supervision Service
dated January 22, 2019

**SAFETY GUIDE
IN THE USE OF ATOMIC ENERGY "RECOMMENDATIONS FOR VULNERABILITY ANALYSIS OF A NUCLEAR FACILITY"**

**(RB-156-19)**

**I. General**

1. This safety guide in the use of atomic energy "Recommendations for vulnerability analysis of a nuclear facility" (RB-156-19) (hereinafter the Safety Guide) has been developed in compliance with Article 6 of the Federal Law No. 170-FZ dated November 21, 1995 "On atomic energy use" for assistance in compliance with the requirements of the items 21, 26 - 30, 48 of the Federal Rules and Regulations for atomic energy use "Requirements for the physical protection systems of nuclear materials, nuclear installations and nuclear materials storage facilities" (hereinafter NP-083-15) approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service No. 343 dated September 8, 2015.

2. The Safety Guide is designed for use of the physical protection of a nuclear facility by the management and personnel performing vulnerability analysis of a nuclear facility (hereinafter vulnerability analysis) and by the specialized organizations participating in the vulnerability analysis.

3. The vulnerability analysis may be made using other procedures (methods) than those given in the Safety Guide, on justification of the selected procedures (methods) for assuring physical protection of nuclear materials, nuclear installations and storage facilities of nuclear materials at the nuclear facility.

4. The Safety Guide uses the concepts stipulated in the Rules of physical protection of nuclear materials, nuclear installations and storage facilities of nuclear materials approved by the Russian Federation Government Decree No. 456 dated July 19, 2007 "On approval of the Rules for physical protection of nuclear materials, nuclear installations and storage facilities of nuclear materials" (hereinafter the Rules of physical protection).

**II. Vulnerability analysis of a nuclear facility**

5. The aim of the nuclear facility vulnerability analysis is to detect any vulnerable points, to define any threats, potential ways of their realization and the violator's model (design basis threat).

The results of vulnerability analysis serve as source data for creation (improvement) of the physical protection system at the nuclear facility and assessment of its efficiency.

Potential threats caused by malicious activities of any adversaries shall be considered in the course of the vulnerability analysis.

6. According to NP-083-15 the vulnerability analysis is made when creating the physical protection system, and:

if threats and adversary model change;

when categories of objects of physical protection and (or) their location change.

The nuclear facility administration may also organize vulnerability analysis in any other cases on its own initiative.

7. It is recommended that the basic stages of vulnerability analysis were:

1) inspection of the nuclear facility;

2) determination of the physical protection objects;

3) identification of vulnerable points;

4) determination of the threats and probable methods of their execution;

5) determination of the adversary model;

6) preparation of vulnerability analysis report.

8. It is recommended to the management of the nuclear facility to form a working group comprising of the following for vulnerability analysis:

1) representatives of the physical protection personnel, including security service staff, and representatives of the special security forces;

2) specialists in design and operation of nuclear installations and nuclear materials storage facilities,including staff competent on issues of nuclear facility functioning;

3) representatives of the specialized organization performing vulnerability analysis (if such an organization participates in the vulnerability analysis by decision of the management of the nuclear facility);

4) specialists in nuclear, radiation, ecological, fire, technical, information and other kinds of safety, and in the sphere of accounting and control of nuclear materials.

It is also recommended to include the representatives of the territorial agencies of internal affairs, National Guard forces and territorial security forces in the working group.

9. It is recommended to develop a plan (program) of vulnerability analysis establishing the deadlines and its procedure.

10. It is recommended that the head of the working group, its composition, tasks and plan (program) of vulnerability analysis were approved by the order of the Director of the nuclear facility.

**III. Inspection of the nuclear facility and determination of the objects of physical protection**

11. The nuclear facility is inspected for preparing the description of the nuclear facility and determination of the places where the physical protection objects are deployed or may be present.

12. On examination it is recommended to study the design documentation at the nuclear facility, perform visual examination of its territory, buildings, structures and rooms, places of location of nuclear materials, nuclear installations and nuclear material storage facilities, elements of the systems and equipment of nuclear installations and storage facilities and draw up the examination results in the form of description of the nuclear facility, which is included in the vulnerability analysis report. It is also expedient to use the documents containing the results of previous vulnerability analyses.

13. The locations of the physical protection objects (nuclear materials and vulnerable places of nuclear installation or nuclear materials storage facility) are determined during investigation of the nuclear facility. It is recommended to engage specialists in design and operation of nuclear installations and nuclear materials storage facilities, safety assurance of critical information infrastructure at the nuclear facility, and staff competent in the issues of nuclear facility functioning for revealing the vulnerabilities.

It is recommended to determine the possible sources and mechanisms of radioactivity leakage or loss of nuclear materials when identifying the vulnerabilities, establish the list and location of the elements, the damage thereof is capable of lead to these consequences.

From among all the composition of elements of the systems, equipment, devices of the nuclear installation or storage facilities such elements are selected, unauthorized actions with respect thereof may lead to unacceptable radiological consequences specified in Appendix No. 2 to the Rules of physical protection.

14. It is recommended to include the following in the description of the nuclear facility:

1) general information on the nuclear facility;

name of the nuclear facility;

type of nuclear facility (for example, nuclear power plant, uranium mining enterprise, nuclear fuel manufacturing plant, enrichment plant, chemical combine, R&D and training organization), specifics of its functioning;

basic characteristics of the nuclear materials storage facility (for example, dry storage, wet storage) and nuclear installations (for example, power reactor of type RBMK-1000, VVER-440, VVER-1000, VVER-1200, research nuclear reactor);

2) peculiarities of the nuclear facility location:

specifics of the relief and vegetation, and other natural specifics on the territory of the nuclear facility and adjoining locality, which the adversary may use during performance of unauthorized actions;

specifics of the adjoining water area (if any);

climatic and weather conditions in the region of the nuclear facility;

specifics of the location of buildings and structures near the object;

specifics of the location of motor and rail roads and underground communications near the object;

specifics of social, political and crime situation in the nuclear facility location area;

3) nuclear facility layout with the basic dimensions and distances specifying:

the perimeter of the facility site as well as the adjacent sites;

buildings, structures and industrial sites with denotation of those on which the objects of physical protections, security forces, control units of physical protection system are deployed;

roads and their types;

enclosures, prohibited areas on the perimeter of protected areas, and individual sections at the territory;

communications and pipelines;

4) list of buildings (structures) where the physical protection objects, control units of physical protection systems, security forces are deployed;

5) information on physical protection objects and places of their deployment:

for nuclear materials and products on their basis - category of nuclear materials according to Appendix No. 1 to the Rules of physical protection;

availability of significant quantity of direct-use materials in accordance with Appendix No. 1 to the Rules of physical protection;

category of the consequences of unauthorized actions in accordance with Appendix No. 2 to the Rules of physical protection;

characteristics of nuclear materials: physical and chemical forms, state, presence within any product, in a container, in the form of accountable units, in bulk form or in any other form;

nuclear materials handling procedure;

full list of vulnerable places for each nuclear installation and nuclear materials storage facility specifyign the places of their location in the building, construction, room;

characteristics of the rooms where the physical protection objects are located (for example, entrances,exits, strength type of the civil structures determining the possibility for adversaries to make any holes in the structures in order to get in, number of windows);

information on the operation states and operation modes of the nuclear installation and nuclear materials storage facility;

arrangements for limitation of access to nuclear materials within the areas of their storage and use (for example, application of special-purpose package, containers, lock boxes);

6) information on intra-facility freighting and transportation, and on the vehicular traffic routes in the protected areas;

7) information from the nuclear materials accounting and control system (description of the material balance area, Regulation on accounting and control of nuclear materials);

8) list of safety class 1 and 2 equipment, and list of equipment of other safety classes taking account of their location;

9) information on any peculiarities related to the personnel work pattern at the facility;

10) availability and location of check points and vehicles at the nuclear facility;

11) information on third-party organizations located at the nuclear facility specifying their places of deployment and places to which access is permitted for the personnel of these organizations.

15. On inspection of the nuclear facility it is recommended tp document the specifics of the systems of nuclear, radiological, fire, technical (process), information security, accounting and control of nuclear materials which may be used by the adversaries for achieving their objectives.

16. If the nuclear facility has other nearby sites apart from the main site, the actions of adversaries on them may pose a threat for the safety of nuclear materials, nuclear installations and nuclear materials storage facilities located on the main site territory of nuclear facility, it is recommended to examine such sites (for example, if during transportation of nuclear materials the site for reloading nuclear materials is located not at the main site of the nuclear facility).

**IV. Determination of the threats and probable methods of their execution**

17. It is recommended to determine the threats to a nuclear facility based on the list of threats of nuclear and radiation hazardous facilities and standard models of adversaries of the federal level and model of adversary (design-basis threat) received from the territorial security agencies.

18. It is recommended to determine the threats to the nuclear facility with respect to each physical protection object or group of same-type physical protection objects for which the threats are homogeneous.

19. It is recommended tp establish the following characteristics when determining the threat:

1) result of threat implementation by the adversaries (theft of nuclear material or sabotage with respect to nuclear materials, nuclear installations, nuclear materials storage facilities or vehicles transporting nuclear materials or nuclear installations), determined with respect to the specific physical protection object or group of physical protection objects;

2) general description of the potential way of implementing an act of sabotage or theft, for example:

potential ways of executing acts of sabotage:

creation of conditions for occurrence of uncontrolled self-supporting chain reaction;

dispersal of nuclear materials including following explosions;

equipment malfunction leading to radioactive releases or interference in the operation mode of the nuclear installation capable of leading to such release;

potential ways of theft:

theft of nuclear materials in containers or without containers, including nuclear materials placed at the nuclear material storage facilities;

removal of nuclear materials from the products containing nuclear materials;

hijacking of vehicles with nuclear materials in it and/or nuclear installations;

3) potential actions of adversaries at the location of any PP object (objects) aimed to commit theft or an act of sabotage;

4) the possibility to move nuclear material by one person or a group of several persons, the need to use a trolley or vehicle in order to transport nuclear material and a lifting device to handle nuclear materials;

5) types (kinds) of tools and accessories required for carrying out sabotages or theft;

6) any other characteristics and peculiarities of the threat.

20. During vulnerability analysis it is recommended to determine the category of the scale of consequences of unauthorized actions with respect to the physical protection objects with justifying calculations and considering the possibility of sabotage using explosives based on the attempt of implementing design-basis threat.

**V. Determination of the model of adversaries (design basis threats)**

21. It is recommended to provide the data and characteristics of the adversaries in the model of adversaries (design-basis threat) necessary to commit theft or an act of sabotage with due regard for the entire variety of the adversary's actions. It is not recommended to include such potential adversaries in the model of adversaries (design-basis threat), who should be neutralized not by the facility's physical protection system but by the actions of state physical protection system organized by other agencies and organizations operating outside the nuclear facility or at the nuclear facility territory in the stipulated cases.

22. The management of the nuclear facility is recommended to organize cooperation with the security agencies, which in accordance with the item 10 of the Rules of physical protection provide for the development and sending of the models of adversaries (design-basis threats) to the management of the nuclear facility.

23. It is recommended for the management of the nuclear facility to highlight (structure in the vulnerability analysis report) the following characteristics and information about the potential adversaries from the model of adversaries (design-basis threat) received from the territorial agency of the Russian Federal Security Service.

1) the types of adversaries considering the established standard model of adversaries by the attribute of access right to the nuclear facility:

external adversaries;

internal adversaries having access right to the protected areas, buildings, structures, rooms, to the nuclear materials, vulnerable points of the nuclear installations;

external adversaries acting in collusion with the internal adversaries;

2) for internal adversaries viz.the groups of adversaries with authorized access to certain protected zones, buildings, structures and rooms; for each category of internal adversaries it is recommended to specify the access procedure to the territory of the facility, protected zones and controlled access areas, to any buildings and rooms, to the territory of production sites during and outside the working hours, on weekends and holidays, in regular and emergency situations;

3) the following categories of adversaries by signatures of unauthorized actions: terrorists (saboteurs), criminals, extremists, accomplices to other categories of adversaries, intruders;

4) the following characteristics for each type of adversaries:

motivation (political, ideological, economic, personal motives);

maximum number of external and internal adversaries in groups;

education and professional experience;

the level of ordinary preparation based on the public information studying and self-preparation;

the level of general military training of the general-duty military units or private security agencies;

the level of special training of the special action forces and terrorist organizations;

type of weapons the adversaries of the relevant types, groups and categories can use;

explosives considering their quantity and types;

tools and devices the adversaries can use in order to overcome any physical barriers and to break protective structures;

vehicles the adversaries can use to move towards the facility, penetration into the facility and within its territory;

possibility to use unmanned aerial vehicles;

degree of the adversary's knowledge about the nuclear facility and its PPS:

general arrangement of buildings and structures, layout of roads and pathways, enclosures of the zones within the territory;

the nature of the PP objects and their location within the zones, buildings, structures, rooms;

information on security of the facility (numerical strength and deployment of the security forces), access procedure to the nuclear facility, to the guard-houses and security posts, to the nuclear facility zones and buildings;

qualification of adversaries (knowledge of blasting work, small arms, hand to hand fight, awareness about the specifics of a specific nuclear facility and its physical protection system);

5) information on the actions of violators, for example:

forms of theft and acts of sabotage:

an overt attack against the nuclear facility (breaking through the perimeter and the PP boundaries, suppression or killing of the opposing security staff and the facility personnel);

covert penetration (passing through the checkpoint by deceptive means; passing through the PP boundaries in any cunning ways, in a concealed manner, with bypassing of the detection equipment, blocking of alarms and TV images, masking against identification by the CCTV facilities; with concealed departure from the facility after commitment of sabotage or theft);

the combined form viz. covert intrusion to the locations of the security staff (the guard buildings) with subsequent open attack, suppression or killing of the security staff; then - straightforward intrusion to the locations of the PP objects in order to commit theft or an act of sabotage with subsequent overt breakthrough out of the nuclear facility territory;

options for overcoming the physical barriers;

options for passage, vehicular passage through the entry control points;

the possibility to capture any tools and devices as well as vehicles located within the nuclear facility territory;

the possibility for the adversaries to get in through the adjacent water zone using any floating craft or self-contained underwater breathing apparatus;

battle tactics.

24. Additional characteristics and specifics of the types of potential violators may be determined by the work group decision.

**VI. Development of the nuclear facility vulnerability analysis report**

25. The recommendations for drawing up the vulnerability analysis report are given in the Position on composition and content of the vulnerability analysis report of a nuclear facility, approved by the order of the Federal Environmental, Industrial and Nuclear Supervision Service No. 765 dated December 19, 2011.