Approved by
Order of the Federal Environmental, Industrial and Nuclear Supervision Service
dated May 15, 2013 No. 209

SAFETY GUIDE IN THE USE OF ATOMIC ENERGY
"REASONS AND CAUSES DEFINITION OF SAFETY REQUIREMENTS VIOLATIONS' APPEARANCE AT NUCLEAR ENERGY USAGE"

(RB-083-13)

I. General

1. This safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" (RB-083-13) (hereinafter the Safety Guide) has been developed in accordance with article 6 of the Federal law dated November 21, 1995 No. 170-FZ "On atomic energy use" for facilitating compliance with the requirements of the Federal rules and regulations in the use of atomic energy: "General safety regulations of nuclear power plants (OPB-88/97)" approved by the Ordnance of Gosatomnadzor of Russia dated November 14, 1997 No. 9; "General safety regulations of the nuclear research installations" (NP-033-11) approved by the Order of Rostechnadzor dated June 30, 2011 No. 348 (registered by the Ministry of Justice of Russia on August 29, 2011, registration No. 21700); "General safety regulations of the nuclear fuel cycle facilities (GSR NFCF)" (NP-016-05) approved by the Ordnance of Rostechnadzor dated December 2005 No. 11 (registered by the Ministry of Justice of Russia on February 1, 2006, registration No. 7433); "General safety regulations of nuclear power plants of ships" (NP-022-2000) approved by the Ordnance of Gosatomnadzor of Russia on September 27, 2000. No. 5; "General safety regulations of radioactive sources" (NP-038-1), approved by the Ordnance of Rostechnadzor dated March 15, 2011 No. 104 (registered by the Ministry of Justice of Russia dated April 25, 2011, registration No. 20564) and assistance for the Federal Environmental, Industrial and Nuclear Supervision Service to exercise the powers stipulated in the sub-items 5.3.1.1, 5.3.8, 6.6 of the Provision on the Federal Environmental, Industrial and Nuclear Supervision Service approved by the Russian Federation Government Decree dated July 30, 2004. No. 401.

2. This Safety Guide contains the recommendations of the Federal Environmental, Industrial and Nuclear Supervision Service on the analysis procedure of the non-compliance with the requirements of the Federal Rules and Regulations in the field of atomic energy use for safety assurance for use of atomic energy and license conditions, identified by Rostechnadzor and its territorial administrations during Federal State supervision over the organizations carrying out activity in the field of atomic energy use (hereinafter the regulated companies).

3. This Safety Guide shall be applicable to the activity with respect to the nuclear facilities.

4. This Safety Guide is used by the Interregional Territorial Administration of Rostechnadzor for supervision over nuclear and radiation safety when performing federal state supervision over nuclear and radiation safety.

5. The requirements of the Federal Rules and Regulations in the field of atomic energy use may be implemented through the use of any other techniques (methods) different from the ones specified in this Safety Guide subject to substantiation of the selected techniques (methods) for safety assurance.

6. The list of abbreviations is given in Appendix No. 1, and terms and definitions are given in Appendix No. 2 to this Guide.

II. Basic provisions of disturbance analysis and determination of their causes

7. The disturbances identified during verification (inspection) of the legal entity's compliance with the mandatory requirements, license conditions required for safety assurance in the process of activity in the field of atomic energy use, and the compliance of the nuclear facilities, their systems (components) with the specified requirements are subject to analysis.

8.The establishment of immediate and root causes of these disturbances is understood in this Safety Guide under the determination of the causes and conditions of occurrence of disturbances.

9. It is recommended to use the classifier of disturbances given in the tables 1 and 2 of this Safety Guide and in Appendix No. 3 - 7 to this Safety Guide when determining the causes of occurrence of disturbances.

10. The analysis of the identified disturbances for determining the immediate and root causes of their occurrence is recommended to perform in the following sequence:

1) determination of the events leading to the identified disturbances;

2) assessment of the influence of identified disturbances on the safety of nuclear facility;

3) determination of the causes of disturbance occurrence conditioned by the errors of employees (personnel);

4) determination of the causes of occurrence of non-compliance with the safety requirements during designing, engineering design, manufacture, operation of the safety-related systems (components);

5) determination of other causes (external impact of natural and human induced factors).

11. The description of the events leading to the disturbances is recommended to formulated briefly, exactly, not allowing different interpretations.

III. Assessment of the impact of identified disturbances on the safety

12. Under the impact of identified disturbances on safety is understood their impact on the state (characteristics) of:

1) physical barriers;

2) measures for protection of physical barriers and maintenance of their efficiency;

3) systems, components of nuclear facility of safety classes 1, 2, 3;

4) environmental contamination: effluents, discharges, exposure of personnel, exposure of the population.

13. The assessment of the impact of disturbances on safety is recommended to perform based on design materials, safety reports (safety cases), operation documents, instructions and guides determining the personnel actions, and assessment of the actual state of the nuclear facility.

14. Each identified non-compliance is recommended to assess by the actual (by actual consequences) and potential (by possible consequences) impact on safety.

15. Assessment of the impact of identified violations on safety is proposed to perform by the inspectorial staff expertly.

16. The occurrences, consequences thereof impact or may impact safety are selected by the inspectorial staff for analysis for the purpose of establishing the direct and root causes of their origin and are determined in accordance with the classifiers of occurrences of the inspection facilities.

IV. Occurrence classifiers

17. The occurrences actual and potentially impacting safety are divided by their belonging to the organization of:

1) production process according to Appendix No. 3 to this Safety Guide;

2) work with the documents according to Appendix No. 4 to this Safety Guide;

3) work with personnel according to Appendix No. 5 to this Safety Guide;

4) works during designing, engineering design, manufacturing, operation of the safety-related systems (components) according to Appendix No. 6 to this Safety Guide;

5) monitoring over the environmental condition according to Appendix No. 7 to this Safety Guide.

18. Place of occurrence in the classifier of occurrences (Appendix No 3 - 7 to this Safety Guide) is recommended to determine by he belonging of the event leading to the occurrence, to non-executed operation function, work of one or other category of personnel.

19. The classifier of occurrence, the cells thereof after classification of the occurrences remained unfilled certify about the normal organization of the production process, work with the documents, personnel, safety-related systems (components), organizing monitoring of the environmental condition.

20. The results of classification of occurrence is recommended to use on establishment of the immediate and root reasons of their occurrence and when planning inspections.

21. The scope of classifiers may be expanded if required by changing the list of work functions, works given in the classifiers of occurrences, given in Appendix No. 3 - 7 to this Safety Guide.

V. Determination of the causes of disturbance occurrence conditioned by the errors of employees (personnel)

22. The causes of origin of occurrences conditioned by the errors of employees (personnel) are recommended to determine in accordance with the classifier given in table 1 of this Safety Guide.

Table 1

CLASSIFIER OF THE CAUSES OF ORIGIN OF OCCURRENCES CONDITIONED BY THE ERRORS OF EMPLOYEES (PERSONNEL)

|  |  |
| --- | --- |
| Immediate causes | Root causes |
| Resource unavailability |
| Contractor not appointedController not appointed | Inadequacy of the administrative management system |
| Deficit of personnelDeficit of equipmentDeficit of material resourcesDeficit of financial resources | Inadequacy of the system of resource allocation of the works |
| Non-availability of contractors and controllers |
| Lack of knowledge of job functionsIgnorance of the subject of activityLack of knowledge of the procedureLack of skills | Imperfection of the system ofpersonnel training |
| Medical and psycho-physiological unpreparedness of the contractors and controllers |
| Non-execution of job functions | Imperfection of the system of safety culture formation Ignoring the results of medical and psycho-physiological examination. |
| Erroneous actions | Personality traits |
| Unpreparedness of the works performance and control procedures |
| Lack of proceduresIncorrectness of the procedures | Imperfection of the document handling system |

23. Immediate causes of the occurrence of failures conditioned by the errors of employees (personnel) are divided into causes of internal and external origin. The causes of internal origin reflect the physical, physiological and emotional state of the work contractor (availability of medical and psychophysiologial contraindications). The causes of external origin reflect the inadequacy of his theoretical knowledge, knowledge of operation documents, production process, personality traits.

24. The root causes of occurrence of failures point to the external circumstances with respect to the work contractor conditioned by the errors in organization of works with documents and personnel.

25. Determination of the causes of occurrence of failures is based on the provision that the failures conditioned by the errors of employees (personnel) are the consequence of non-compliance by the personnel of regulated entities with the conditions assuring the performance by the system of organizational support of the production process of the work functions (works) given by it. Such conditions are as follows:

1) resource readiness assurance of work performance;

2) assurance of engineering, medical and psychophysical readiness of the work contractors and controllers;

3) readiness assurance of the works performance and oversight procedures.

Each of the readiness conditions has attributes of performance.

26. Attributes of resource readiness assurance of work performance;

1) work contractor has been appointed;

2) controller has been appointed;

3) work provided with equipment;

4) work provided with material resources;

5) work provided with financial resources.

27. Attributes of technical readiness assurance of the work contractors and controllers:

1) know the job function;

2) know the subject of activity;

3) know the procedures;

4) have work performance skills.

28. Attributes of readiness assurance of the work performance and oversight procedures:

1) procedures are available;

2) procedures are correct.

29. Attributes of assuring medical and psycho-physiological readiness of the work contractors are determined by the psycho-physiological analysis procedure used by the psycho-physiological examination laboratory, results of medical examination. The inspection task consists in the verification of the fact of record of the results of medical and psycho-physiological examination by the designated persons allowing the contractor to work.

30. Since the failures may be classified as the consequence of non-compliance with the readiness assurance conditions, the attributes of non-compliance with these conditions are the immediate causes of occurrence of failures.

In the classifier of the causes of non-compliances occurrence conditioned by employee (human) errors given in the table 1 of this Safety Guide, the non-fulfilment of the conditions of readiness assurance shall include non-availability of resources, contractors and controllers not operationally ready, medical and psycho-physiological unpreparedness of the contractors and controllers, non-availability of procedures for performing and control of performing works specifying the attributes of non-availability which simultaneously are the immediate causesof occurrence of non-compliances. The root causes of occurrence of non-compliances are expressed as the circumstances of availability (manifestation) of the immediate causes of the non-compliances.

31. The unfulfilled job function shall be determined according to the event that lead to identification of non-compliance, and corresponding to the non-compliance classifier in accordance with Appendix No. 3 - 5 to this Safety Guide.

32. The response to the following questions, related to the identification of the formal attributes for providing the job with qualified personnel and documentation (under personnel it is understood executors and controllers), is recommended to get in the form of "yes - no":

1) has the work performance procedure been established or not?

2) is the procedure correct or not?

3) whether the personnel for performing this work has been appointed or not?

4) whether its performance is the job duty of the personnel or not?

5) had the personnel undergone training in the scope of the procedure or not?

6) had the personnel undergone knowledge assessment according to the procedure or not?

7) is the personnel familiar with its job duties and procedure or not?

8) whether the personnel was allowed for independent work or not?

33. The immediate cause (causes) of the occurrence of non-compliance is denoted by the negative response (responses). Thus, for example, of the negative response was received for the question: "Had the personnel undergone training in the scope of the procedure or not?", then the cause of occurrence of the non-compliances is formulated according to the classifier of the causes of non-compliance occurrence conditioned by employee (human) errors, as "Lack of knowledge of the procedure".

34. If positive responses have been received to all the questions certifying about the formal work assurance, it is recommended to get the responses for the following questions:

1) Does the executor know the job description or not?

2) Does he know the subject of activity or not?

3) Does he know or understand the work execution procedure or not?

4) Does he have practical skills or not?

35. It may be concluded by the content of responses about the status of the training system and maintenance of personnel qualification and his personnel traits.

36. Thus, for example, if the personnel knows, understands the procedure and get things done, but makes the wrong practical moves. then the immediate cause of the occurrence of non-compliance is qualified as "wrong actions". If the personnel knows, understands the procedure and get things done, but makes the wrong moves, the immediate cause of non-compliacne occurrence is qualified as "Failure to fulfill the job duties".

It is recommended to get the responses to the following questions for determining the root causes of non-compliance occurrence in these two cases:

1) did the executor undergo training on formation of safety culture or not?

2) are there medical and psycho-physiological contraindications for performing the given work or not?

37. The root cause of non-compliance occurrence is qualified as "Personality traits" if the response is positive to the question contained in the sub-item 1 of item 36, and the response is negative to the question contained in the sub-item 1 of item 36.

Algorithm for determining the immediate and root causes of occurrence of non-compliances conditioned by the employee (human) errors is given in Appendix No. 8 to this Safety Guide.

38. For establishing the officials of regulated companies allowing the creation of conditions of appearance (manifestation) of immediate causes of non-compliance occurrences it is recommended to:

1) get response to the question: "Which work was not executed?" If correct response is received, then:

2) get response to the question: "Is the work formalized or not in the manufacturing instruction?" If the response is "no", the responsibility for violation is borne by the developer of instruction and controller. If the response is "yes", then:

3) get response to the question: "Has the personnel been appointed or not for performing this work?" If the response is "no", the responsibility for violation is borne by the official obliged to appoint the personnel. If the response is "yes", then:

4) get response to the question: "Is the performance of work the job duty of the personnel or not?" If the response is "no", the responsibility for violation is borne by the developer of job procedure and person permitting the personnel for the job. If the response is "yes", then:

5) get response to the question: "Did the personnel undergo training in the scope of local manual for execution of work or not? If the response is "no", the responsibility for violation is borne by the developer of training program and person monitoring the execution of this program. If the response is "yes", then:

6) get response to the question: "In the personnel familiar with the job and local manuals or not?" If the response is "no", the responsibility for violation is borne by the relevant official or controller. If the response is "yes", then:

7) get response to the question: "Had the personnel passed the knowledge assessment for performing work?" If the response is "no", the responsibility for violation is borne by the Head of personnel training and controller. If the response is "yes", then:

8) get response to the question: "Has the personnel been allowed for independent work or not?" If the response is "no", the responsibility for violation is borne by the relevant official or controller. If the response is "yes", then:

9) check, whether the personnel has knowledge of the work performance procedure or not. If the response is "no", then it is imperfection of the personnel training system, and immediate cause refusal may be qualified as a human error. If the response is "yes", then:

10) check, whether the personnel understands the work performance procedure or not. If the response is "no", then it is imperfection of the personnel training system, and immediate cause refusal may be qualified as a wrong decision of the personnel. If the response is "yes", then:

11) get response to the question: "Are there medical contraindications for the personnel for performing work or not? If the response is "yes", the liability for non-compliance shall be borne by the relevant officials, who had ignored the recommendations of the medical committee, and persons controlling them. If the response is "no", then:

12) get response to the question: "Do the personnel have psycho-physiological contraindications to performance of work or not?" If the response is "yes", the liability for non-compliance shall be borne by the relevant officials, who had ignored the recommendations of the psycho-physiological laboratory, and persons controlling them.

39. The algorithm for establishing the officials of the regulated companies, who had allowed the creation of circumstances of the availability (manifestation) of immediate causes of occurrence of the non-compliances, has been given in Appendix No. 10 to this Safety Guide.

VI. Determination of the causes of occurrence of non-compliances with the safety requirements during designing, engineering design, manufacture, operation of the safety-related systems (components)

40. The causes of occurrence of non-compliances with the safety requirements during designing, engineering design, manufacture, operation of the safety-related systems (components) are recommended to determine in accordance with the classifier given in the table 2 of this Safety Guide.

Table 2

CLASSIFIER OF THE CAUSES OF OCCURRENCE OF NON-COMPLIANCES WITH THE SAFETY REQUIREMENTS DURING DESIGNING, ENGINEERING DESIGN, MANUFACTURE, OPERATION OF SAFETY-RELATED SYSTEMS (COMPONENTS)

|  |  |
| --- | --- |
| Immediate causes | Root causes |
| Internal |
| Conditioned by:- changes of the physical state;- changes of the chemical processes;- changes of the environmental conditions;- errors of personnel, erroneous decisions when carrying out activity (operation, maintenance, repair, decommissioning) with respect to safety-related systems (components) | Conditioned by the errors of organization of works and their quality during:- operation;- maintenance;- repair;- decommissioning |
| External |
| Conditioned by the errors of personnel, erroneous decisions during activity (designing, engineering design, manufacture, construction, installation, adjustment and tests) with respect to the safety-related systems (components) | Conditioned by the errors of organization of works and their quality during:- designing;- engineering design;- manufacture;- construction;- installation;- adjustment;- tests |

41. The immediate and root causes of occurrence of non-compliance with the safety requirements during the designing, engineering design, manufacture, construction, installation, adjustment, tests, operation, maintenance, repair, decommissioning of the safety-related systems (components) are divided into reasons of internal and external origin.

42. Immediate causes of of internal origin non-compliance occurrence are conditioned by the following factors:

1) changes of the physical state;

2) changes of the chemical processes;

3) changes of the operation conditions;

4) human errors, wrong decisions during activity (operation, maintenance, repair, decommissioning) with respect to the safety-related systems (components)/.

43. Root causes of internal origin non-compliance occurrence are conditioned by the errors of work organization and their quality during the operation, maintenance, repair, decommissioning (i.e during operation and decommissioning).

44. Immediate causes of external origin non-conformance occurrence are conditioned by human errors, wrong decisions during activity (designing, engineering design, manufacture, construction, installation, adjustment, tests (i.e. before commissioning).

45. Root cause of external origin non-conformance occurrence are conditioned by the errors of work organization and their quality during designing, engineering design, manufacture, construction, installation, adjustment, tests (i.e. before commissioning).

46. The non-executed job function, work is determined according to the event lead to the identified non-compliance and corresponding to the non-compliance classifiers in accordance with Appendix No. 3, 4, 6, 7 to this Safety Guide.

47. A step by step algorithm of actions is recommended to develop and use for each facility in the form of getting responses "yes - no" to the questions related to the identification of the causes at the organization of non-compliance of performing the job function, works and its quality specified in the relevant classifiers.

The following are determined by using the step by step algorithm:

- factor conditioning the manifestatation (availability) of non-comliance;

- immediate cause of non-compliance;

- root cause of non-compliance;

The algorithm for determining the immediate and root causes of occurrence of non-compliance with the requirements on safety assurance during designing, engineering design, manufacture, construction, installation, adjustment, tests, operation, maintenance , repair, decommissioning of the safety-related systems (components) is given in Appendix No. 9 to this Safety Guide.

48. It is recommended to use the step by step algorithm of actions given in Appendix No. 10 to this Safety Guide for establishing the officials of regulated companies, which had allowed the creation of circumstances of availability (manifestation) of the immediate cause of non-compliances.

49. Using thus established causes of occurrence of non-compliances with the safety requirements it is recommended for the regulated companies to develop measures for their elimination and non-recurrence, and consider the issue of holding the officials of the regulated companies allowing the creation of conditions of availability (manifestation) of the immediate causes of non-compliances.

50. The specific example of use of this Safety Guide are given in Appendix No. 11 to this Safety Guide on establishing the immediate and root causes of occurrence of non-compliance with the safety requirements.

Appendix No. 1
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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ABBREVIATIONS

|  |  |  |
| --- | --- | --- |
| I&C&A | - | Instrumentation and control and automation |
| SSE | - | safe shutdown earthquake |
| RD | - | regulatory documents |
| AO | - | abnormal operation |
| NO | - | normal operation |
| PPD | - | operational documents |
| OAD | - | organizational and executive documentation |
| ReD | - | reporting documents |
| OBE | - | operating basis earthquake |
| DED | - | design and engineering documentation |
| IED | - | industrial engineering documentation |
| CS | - | company standard |
| RM HW | - | Radiation monitoring hardware |
| RM AC HW | - | radioactive materials accounting and control hardware |
| PP TM | - | physical protection technical means |
| LVC | - | License validity conditions |
| TD | - | Teaching documentation |
| AcD | - | Accounting documents |
| FRR | - | Federal rules and regulations |
| OO | - | Operating Organization |

Appendix No. 2
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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TERMS AND DEFINITIONS

The root cause of non-compliance is the circumstance which has created the conditions for apperance or manifestation of the direct cause of non-compliance.

The immediate cause of non-compliance is the phenomenon or process conditioning the deviation from the normal flow of the process following system (component) failure or employee (human) error.

The requirements for safety assurance when using nuclear energy is the set of requirements established by the regulatory legal acts of the Russian Federation, Federal standards and rules in use of atomic energy, license validity conditions of Rostechnadzor and its territorial authorities for right of carrying out stipulated kinds of activity, regulatory legal acts of Rostechnadzor and other regulatory acts, compliance thereof is subject to state supervision of Rostechnadzor and its territorial authorities.

Appendix No. 3
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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CLASSIFIER OF NON-COMPLIANCES

PROCESS ORGANIZATION

|  |  |
| --- | --- |
| Job functions of personnel, works to which non-compliances are referred | Categories of personnel, having allowed the non-compliance |
| Personnel of nuclear facility | Personnel of OO | Personnel of third-party organizations |
| Operating | Head of facility | Heads of divisions | Specialists of divisions |
| Determination and formalization of the scope of safety-related works |  |  |  |  |  |  |
| Determination and formalization of the authorities and duties of OO and facility |  |  |  |  |  |  |
| Determination and formalization of the authorities and duties of the facility divisions |  |  |  |  |  |  |
| Determination and formalization of the authorities and duties of facility personnel |  |  |  |  |  |  |
| Regulatory support |  |  |  |  |  |  |
| Labor support |  |  |  |  |  |  |
| Financial resources assuance |  |  |  |  |  |  |
| Material resources assurance |  |  |  |  |  |  |
| Document support of work places |  |  |  |  |  |  |
| Ergonomic support of work places (conditions, process and work equipment) |  |  |  |  |  |  |
| Official follow-up action of works |  |  |  |  |  |  |
| Departmental safety assurance follow-up action |  |  |  |  |  |  |
| Development of control system and procedure assessment |  |  |  |  |  |  |
| Competency and degree of training of specialists |  |  |  |  |  |  |
| Conformance analysis of the facility and its activity with the requirements of FRR and LVC |  |  |  |  |  |  |
| Development of measures for eliminating (compensating) identified departures from FRR and LVC |  |  |  |  |  |  |
| Development of a program for eliminating (compensating) identified departures from FRR and LVC |  |  |  |  |  |  |

Appendix No. 4
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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CLASSIFIER OF NON-COMPLIANCES

WORK ORGANIZATION WITH DOCUMENTS

|  |  |
| --- | --- |
| Types of works to which the non-compliance is referred | Nomenclature of documents |
| RD | LVC | CS | DED | IED | OAD | TD | PPD | ReD | AcD |
| Maintaining |  |  |  |  |  |  |  |  |  |  |
| Conformance analysis |  |  |  |  |  |  |  |  |  |  |
| Bringing into compliance |  |  |  |  |  |  |  |  |  |  |
| Development |  |  |  |  |  |  |  |  |  |  |
| Concurrence |  |  |  |  |  |  |  |  |  |  |
| Approval  |  |  |  |  |  |  |  |  |  |  |
| Commissioning |  |  |  |  |  |  |  |  |  |  |
| Introduction of amendments |  |  |  |  |  |  |  |  |  |  |
| Introduction of amendments |  |  |  |  |  |  |  |  |  |  |
| Review |  |  |  |  |  |  |  |  |  |  |
| Familiarization |  |  |  |  |  |  |  |  |  |  |
| Execution |  |  |  |  |  |  |  |  |  |  |
| Monitoring execution |  |  |  |  |  |  |  |  |  |  |
| Submission to the supervisory authorities |  |  |  |  |  |  |  |  |  |  |

Appendix No. 5
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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CLASSIFIER OF NON-COMPLIANCES

ORGANIZATION OF WORK WITH PERSONNEL

|  |  |
| --- | --- |
| Works related to personnel | Personnel categories |
| Personnel of nuclear facility | Personnel of OO |
| Operating | Head of facility | Heads of divisions | Specialists | Workers |
| Medical examination |  |  |  |  |  |  |
| Psycho-physiological Checkup |  |  |  |  |  |  |
| Preparation |  |  |  |  |  |  |
| Knowledge examination |  |  |  |  |  |  |
| Skills check |  |  |  |  |  |  |
| Practice |  |  |  |  |  |  |
| Clearance to work unsupervised |  |  |  |  |  |  |
| Qualification maintaining |  |  |  |  |  |  |
| Advance training |  |  |  |  |  |  |
| Competence assessment |  |  |  |  |  |  |

Appendix No. 6
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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CLASSIFIER OF NON-COMPLIANCES

ORGANIZATION OF WORKS DURING DESIGNING, ENGINEERING DESIGN, MANUFACTURE, OPERATION OF SAFETY-RELATED SYSTEMS (COMPONENTS)

|  |  |
| --- | --- |
| Job functions of personnel, works to which non-compliances are referred | Name of systems and components |
| Buildings and structures | Mechanical systems | Electrical systems | I&C&A | RM HW | PP TM | RM AC HW |
| Compliance with the rules for design |  |  |  |  |  |  |  |
| Compliance with the design characteristics |  |  |  |  |  |  |  |
| Receipt |  |  |  |  |  |  |  |
| Storage |  |  |  |  |  |  |  |
| Incoming inspection |  |  |  |  |  |  |  |
| Installation |  |  |  |  |  |  |  |
| Adjustment |  |  |  |  |  |  |  |
| Tests |  |  |  |  |  |  |  |
| Operation |  |  |  |  |  |  |  |
| Verification |  |  |  |  |  |  |  |
| Repair |  |  |  |  |  |  |  |
| Maintenance |  |  |  |  |  |  |  |
| Metal testing |  |  |  |  |  |  |  |
| Diagnostics |  |  |  |  |  |  |  |
| Engineering examination |  |  |  |  |  |  |  |
| Radiation examination |  |  |  |  |  |  |  |
| Assignment of lifetime |  |  |  |  |  |  |  |
| Prolongation of lifetime |  |  |  |  |  |  |  |
| Dismantling |  |  |  |  |  |  |  |
| Upgrade |  |  |  |  |  |  |  |

Appendix No. 7
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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CLASSIFIER OF NON-COMPLIANCES

ORGANIZING ENVIRONMENTAL CONTROL

|  |  |  |
| --- | --- | --- |
| Name of indicator | Characteristic | Environment categories |
| Facility room | Facility site | Sanitary protection zone | Surveillance zone |
| State parameters to which the non-compliance is referred | Compliance with the rules for design |  |  |  |  |
| Compliance with the design characteristics |  |  |  |  |
| Works to which the non-compliance is referred  | Radiation Control |  |  |  |  |
| Radiation examination |  |  |  |  |

Appendix No. 8
to the safety guide in the use of atomic energy "Reasons and causes definition of safety requirements violations' appearance at nuclear energy usage" approved by the Order of the Federal Environmental, Industrial and Nuclear Supervision Service
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ALGORITHM FOR
DETERMINATION OF IMMEDIATE AND ROOT CAUSES OF NON-COMPLIANCE OCCURRENCE CONDITIONED BY EMPLOYEE (HUMAN) ERRORS

|  |
| --- |
| Determination of the pending work (operating function) in accordance with the classifiers given in Appendices No. 3 - 5 |
|  |  |  |  |  |
|  |  | Immediate cause |  | Root cause |
|  |  |  |  |  |
| Has the work performance procedure been established or not? | no | No procedure |  | Imperfection of the document handling system |
| Yes |  |  |  |
| Is the procedure correct or not? | no | Inappropriate procedure |  |
| Yes |  |  |  |  |
| Whether the personnel for performing this work has been appointed or not? | no | Contractor not appointed |  | Inadequacy of the administrative management system |
| Yes |  |  |  |  |
| Is the performance of work the job duty of the personnel or not? | no | Inappropriate procedure |  | Imperfection of the document handling system |
| Yes |  |  |  |  |
| Had the personnel undergone training in the scope of procedure or not? | no | Lack of knowledge of the procedure |  | Imperfection of the personnel training system |
| Yes |  |  |  |
| Did the personnel undergo knowledge assessment according to the procedure or not? | no | Lack of knowledge of the procedure |  |
| Yes |  |  |  |
| Is the personnel familiar with the job duties and procedure? | no | Ignorance of the subject of activity |  |
| Yes |  |  |  |
| Is the personnel permitted to work unsupervised or not? | no | Lack of skills |  |
| Yes |  |  |  |
| Work is formally assured  |  |  |  |  |
|  |  |  |  |  |
| Does the executor know the job description or not? | no | Lack of knowledge of job functions |  | Imperfection of the personnel training system |
| Yes |  |  |  |
| Does the executor know the subject of activity or not? | no | Ignorance of the subject of activity |  |
| Yes |  |  |  |
| Does the executor know or understand the work execution procedure or not? | no | Lack of knowledge of the procedure |  |
| Yes |  |  |  |
| Does the executor have practical skill or not? | no | Lack of skills |  |
| Yes |  |  |  |  |
| The executor makes incorrect practical steps | no | Erroneous actions |  | Imperfection of the system of safety culture formationPersonality traits |
| Yes |  |  |  |
| Contractor does not take practical steps | no | Non-execution of job functions |  |

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ALGORITHM FOR
DETERMINATION OF THE DIRECT AND ROOT CAUSES OF THE OCCURRENCE OF BIB-COMPLIANCES WITH THE SAFETY REQUIREMENTS DURING DESIGNING, ENGINEERING DESIGN, MANUFACTURE, OPERATION OF SAFETY-RELATED SYSTEMS (COMPONENTS)

|  |  |  |
| --- | --- | --- |
|  |  | Determination of the pending work (operating function) in accordance with the classifiers given in Appendices No. 3, 4, 6, 7 |
|  |  |  |  |  |  |  |
|  |  |  |  | Immediate cause |  | Root cause |
|  |  |  |  |  |  |  |
| Internal reasons |  | Is the non-performance of work a consequence of change of the physical state of the safety-related systems (components) or not? | yes | Change of the physical state of the safety-related systems (components)  |  | Errors of the organization of works and their quality during operation, maintenance, repair, decommissioning of the safety-related systems (components) |
|  | No |  |  |  |
|  | Is the non-performance of work a consequence of the changes of chemical processes? | yes | Change of the chemical processes |  |
|  | No |  |  |  |
|  | Is the non-performance of work a consequence of the change of the environmental conditions or not? | yes | Changes of the environmental conditions |  |
|  | No |  |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during operation of the safety-related systems (components) or not? | yes | Human errors, wrong decisions when carrying out activity (operation, maintenance, repair, decommissioning) with respect to safety-related systems (components) |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during maintenance of the safety-related systems (components) or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during repair of the safety-related systems (components) or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during decommissioning of the safety-related systems (components) or not? | yes |  |
|  |  | No |  |  |  |  |
| External reasons |  | Is the non-performance of work a consequence of the human errors, wrong decisions during designing of the safety-related systems (components) or not? | yes | Human errors, wrong decisions when carrying out activity (designing, engineering design, manufacture, construction, installation, adjustment and tests) with respect to the safety-related systems (components) |  | Errors of organization of works and their quality during designing, engineering design, manufacture, construction , installation, adjustment and tests of the safety-related systems (components) |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during engineering design of the safety-related systems (components) or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during manufacture of the safety-related systems (components) or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during designing of the safety-related systems (components) or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions when carrying out construction or not? | yes |  |
|  | No |  |  |
|  | Is the non-performance of work a consequence of the human errors, wrong decisions during installation, adjustment and tests of the safety-related systems (components) or not? | yes |  |

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ALGORITHM
FOR ESTABLISHING THE OFFICIALS OF REGULATED COMPANIES ALLOWING CREATION OF THE CIRCUMSTANCES OF AVAILABILITY (MANIFESTATION) OF IMMEDIATE CAUSES OF NON-COMPLIANCES OCCURRENCE

|  |  |  |
| --- | --- | --- |
| 1) determine which work has not been performed? |  |  |
| yes |  |  |
| 2) determine, whether the work in the local manual has been formalized or not? | no | The effector of the manual, his Director shall be liable for the non-compliance |
| yes |  |  |
| 3) determine, whether the personnel for performing this work has been appointed or not? | no | The official bound to appoint him shall be liable for the non-compliance |
| yes |  |  |
| 4) determine, whether the performance of work the job duty of the personnel or not? | no | The effector of the job procedure, his Director shall be liable for the non-compliance |
| yes |  |  |
| 5) determine, whether the personnel underwent training in the scope of local manual for execution of work or not? | no | The effector of the training program and person monitoring him shall be liable for the non-compliance |
| yes |  |  |
| 6) determine, whether the personnel is familiar with the job and local manual or not? | no | The relevant official and controller shall be liable for the non-compliance |
| yes |  |  |
| 7) determine, whether the personnel had undergone knowledge assessment for performing work or not? | no | The head of the training and controller shall be liable for the non-compliance |
| yes |  |  |
| 8) determine, whether the personnel was allowed for independent work or not? | no | The relevant official and controller shall be liable for the non-compliance |
| yes |  |  |
| 9) check, whether the personnel has knowledge of the work performance procedure or not> | no | Imperfection of the personnel training system and immediate cause refusal may be treated as a wrong decision of the personnel |
| yes |  |  |
| 10) check, whether the personnel understands the work performance procedure or not? | no | Imperfection of the personnel training system and immediate cause failure may be treated as a wring decision of the personnel |
| yes |  |  |
| 11) determine whether there are medical contraindications for the personnel to execute works? | no | The designated persons permitting this personnel for the job, persons supervising them shall be liable for the occurrence |
| yes |  |  |
| 12) determine whether there are psycho-physiological contraindications for job execution? | no | The designated persons permitting this personnel for the job, persons supervising them shall be liable for the occurrence |

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EXAMPLES OF USE OF THIS SAFETY GUIDE ON ESTABLISHMENT OF IMMEDIATE AND ROOT CAUSES OF ORIGIN OF NON-COMPLIANCE WITH THE SAFETY REQUIREMENTS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S. No. | Essence of the identified non-compliance with the safety requirements | Numbers of the violated items of the norms and rules in the field atomic energy use | Classification of violation | Immediate cause leading to these violations | Root cause leading to these violations | Note |
| 1.  | The following documents are not available at the N-th NPP:- nomenclature of the safety-related components having reached the end of itsservice life and subject to their replacement- nomenclature of safety-related components, the service life thereof may be prolonged at the expense of periodic maintenance and repair;- lists of nonrestorable components and preliminary assessment of their residual service life;- lists of safety-related components with the residual lifetime and the possibility to extend their service life for a certain period; | p. 1, 3, 5 of the appendix to the NP-017-2000 (approved by the Decree of Rosatomnadzor of Russia dated September 18, 2000 No. 4) | Appendix No. 6 to this Safety Guide Classifier of non-compliances Organization of works during designing, engineering design, manufacture, operation of safety-related systems (components).Assignment of lifetimeProlongation of lifetimeThe following functions were not performed: lifetime not determined, lifetime not prolonged | Table 2 of this Guide Human errors when carrying out activity (operation, maintenance) with respect to the safety-critical systems (components) | Table 2 of this Guide Errors of organization of works and their quality assurance during:- operation;- maintenance |  |
| 2.  | The reciprocating compressors at the N-th NPP installed on the starting air system of the diesel generators (classified notation according to OPB-88/97 "3O" have reached the end of its service life of 3000 hours established by the manufacturer and continue to be operated at the N-th NPP | p. 1.2.3 OPB-88/97 (approved by the Ordnance of Gosatomnadzor of Russia dated November 14, 1997. N 9) | Appendix No. 6 to this Safety Guide Classifier of non-compliances Organization of works during designing, engineering design, manufacture, operation of safety-related systems (components).Assignment of lifetimeProlongation of lifetimeThe following functions were not performed:overage, lifetime not prolonged | Table 2 of this Guide Human errors when carrying out activity (operation, maintenance) with respect to the safety-critical systems (components) | Table 2 of this Guide Errors of organization of works and their quality assurance during:- operation;- maintenance |  |
| 3.  | The calculation for combination of loads NO+SSE and NOF+SSE has been made for the N-th NPP not for all the systems (components) classified under seismic category 1 as per NP-031-01. Thus, according to the submitted calculation for strength of spent fuel pool shutdown cooling pipelines on justification of their seismic resistance, the combination of loads NO+DBE is taken in the calculation for seismic strength, but the calculation was performed for the combination of loads NO+SSE and NOF+SSE | p. 5.4 of NP-031-01 (approved by the Ordnance of Gosatomnadzor of Russia dated October 19, 2001. N 9) | Appendix No. 6 to this Safety Guide Classifier of non-compliances Organization of works during designing, engineering design, manufacture, operation of safety-related systems (components).Device complianceThe following function was not performed: Device compliance not justified | Table 2 of this Guide Human errors when carrying out activities (designing, engineering design) with respect to the safety-critical systems (components) | Table 2 of this Guide Errors of organization of works and their quality assurance during:- designing;- engineering design |  |
| 4.  | Quality assurance program during operation of N-th QAS NPP (O) does not contain information on the applicable warning procedures of potential deviations and non-conformities. | Appendix No. 1, section 16 NP-011-99 (approved by the Ordnance of Gosatomnadzor of Russia dated December 21, 1999 No. 4) | Appendix No. 4 to this Safety GuideAppendices Classifier of disturbancesOrganization of works with documents Correspondence analysis Bringing into complianceThe following functions were not performed:Correspondence analysis Bringing into compliance | Table 1 of this Guide Personnel errors. Inappropriate procedure | Table 1 of this Guide Imperfection of the document handling system |  |