Ministry of Energy and Coal Industry of Ukraine
State Enterprise National Nuclear Energy Generating Company "Energoatom"
New Projects and Investments Office

# Explanatory Note

## to the environmental impact evaluation with respect to SU NPP Unit 1 lifetime extension

Yuzhnoukrainsk

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# Approval Sheet

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| ENSREG | European Nuclear Safety Regulators Group |
| INES | International Nuclear Event Scale |
| NPP | Nuclear Power Plant |
| "ASKRO" | Automated Radiation Monitoring System |
| OJSC | Open Joint Stock Company |
| SE NNEGC | State Enterprise National Nuclear Energy Generating Company |
| "Energoatom" | "Energoatom" |
| EC | European Community |
| PSRR | Periodic Safety Review Report |
| C(I)SIP | Comprehensive (Integrated) Safety Improvement Program |
| PJSC | Public Joint Stock Company |
| SF | Safety Factors |

## 1. Introduction

According to "Energy strategy of Ukraine for the Period by 2030" [1], NPP units lifetime extension is considered as one of the necessary implementation conditions of the program tasks and objectives. The design 30-year lifetime of the NPPs in operation was established using an overly conservative approach, based on the level of knowledge available at the time of the unit construction with no substantial experience in the field. The real-life operating experience proved the actual operating term of the major NPP components to be higher than previously assumed, and other components can be replaced at a reasonable cost.

The trend to extend power units operating term is accepted in many countries running nuclear power. Ukrainian NPPs lifetime extension beyond the design limit will allow to maintain energy production at the achieved level and to accumulate the necessary funds for decommissioning of power units without placing too much burden on consumers.

The first Ukrainian VVER-1000 power unit to have its lifetime expired by 31 December 2012 is South-Ukraine NPP Unit 1. Economic efficiency of life extension for Unit 1 is proved by the following figures: the new power unit construction cost, according to international practice, is estimated at approximately UAH 60-80 bn (~ € 5-7 bn), while extending the life of SU NPP Unit 1 is estimated at ~ UAH 3500 per 1 kW of installed capacity or the total of UAH 3,5 bn, which is ~ 5% of the cost needed for the construction of new power unit.

## 2. Ukrainian Legislation and International Treaties Ratified by Ukraine Relevant to Life Extension for SU NPP Unit 1

Procedure for decision making regarding the extension of Ukrainian power units operating term is defined in the Law of Ukraine "On the Order of Decision Making with respect to Siting, Design, Construction of Nuclear Installations and Radwaste Management Facilities of National Importance" [2]. According to Art. 6 of the Law: "Decision to extend operating life of nuclear installations and radwaste management facilities of state importance are adopted by the state nuclear and radiation safety supervisory authority based on the results of the state nuclear and radiation examination by amending the operating license of a nuclear installation or radwaste management facility accordingly ".

One should note that, upon the adoption by the Verkhovna Rada of Ukraine of the Law No. 1566-VI dated 25 June 2009 [3], current provision of Art. 6 of the Law [2] contain no feasibility report and environmental impact evaluation requirement as a condition for the adoption of relevant decision.

At the same time, Ukraine's strategic orientation towards the European Community implies arrangement of conditions needed therefore: deepening of democratic reforms, adjustment of national legislation to that of the EC, expansion of cooperation in a number of areas, in particular, in the field of collective security, and primarily nuclear safety and security, since the nuclear risks and nuclear accidents are potentially transboundary in nature. Special attention is paid to the compliance of

Ukraine with the international treaties. In accordance with the Law of Ukraine "On International Treaties" [4], in the event if international treaty, as duly entered into force, sets rules different than those of the relevant Ukrainian legislation, the international treaty provisions shall be applied (Art. 19).

"Convention on Environmental Impact Assessment in a Transboundary Context" (Espoo Convention) [5] and "Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters" (Aarhus Convention) [6], also signed by Ukraine, plaid a special role in the development of environmental legislation in the EC countries.

### 2.1 Espoo convention

Espoo convention lays down certain obligations of the states with regard to their planned activities (NPPs and other facilities with nuclear reactors included) that are likely to cause a significant adverse environmental impact across boundaries, namely:

- Notification of other parties that may be affected by such activities;
- Preparation of documentation on the evaluation of environmental impacts as a result of planned activities;
- Consultations with the affected parties, carried out on the basis of the environmental impact evaluation documentation;

"Planned activity" is defined as any activity or any major change to an activity subject to a decision of a competent authority in accordance with a national applicable procedure".

Also, "Environmental Impact Evaluation" means a national procedure for evaluating the likely impact of a planned activity on the environment" ([5], Art.1).

Persuant to Art. 2, clause 2 of the Espoo Convention, each party shall undertake the necessary legal, administrative and other measures to fulfill the provisions of this Convention, including with regard to the planned activities that are likely to cause significant adverse transboundary impact, the establishment of the environmental impact evaluation procedure allowing for public participation and preparation of the environmental impact evaluation documentation listed in Appendix II to the Convention [5]:

**Appendix II Content of the environmental impact evaluation documentation.**

According to Art. 4, information to be included in the documentation on the environmental impact evaluation shall contain, as a minimum, the following:

a) description of the planned activity and its purposes;

b) description, where appropriate, of the planned activity's reasonable alternatives (e.g. those of geografical or technological nature), inluding refusal to carry out the activity;

c) description of the elements of environment that are likely to be significantly affected by the planned activity or alternatives thereof;

d) description of the potential environmental impact of the planned activity or its alternatives and the impact rate assessment;

e) description of mitigation measures aimed at minimizing the adverse environmental impact;

f) explicit indication of predictive measures and underlying assumptions as well as the relevant environmental data used;

g) description of the knowledge gaps and uncertainties revealed while preparing the necessary information;

h) where appropriate, summary description of the monitoring and management programs and of all the post-project analysis plans; and

i) where appropriate, non-technical summary with the use of visual materials (maps, graphs etc.).

### 2.2 Aarhus Convention

Major provisions of the Aarhus Convention [6] pertaining to the exention of the SU NPP Unit 1 operating life are about the public dicussion of the planned activity – informing thereon, providing access to the relevant information, public discussion including the possibility to deliver, either in writing or by words of mouth at public hearings, any questions, comments or ideas, and due consideration of the results of public discussion in the relevant decision.

Art. 1 («Objective») of the Convention [6] establishes that each Party shall garantee access to information, public participation in decision making and access to justice on environmental matters.

The term «Party» means Contracting Party to this Convention, and "environmental information" means any information on:

a) the state of the environmental elements, such as air and atmosphere, water, soil, land, landscape and other natural objects, biological diversity and its elements, including genetically modified organisms, and the interaction among these elements;

б) factors, such as substances, energy, noise and radiation, as well as activities or measures, including administrative measures, agreements on environmental subject matters, policies, legislation, plans and programs affecting or having the potential to affect the elements of environment, mentioned in sub-clause a) above, and cost-benefit analysis and other economical analysis and assumptions used in decision-making on environmental matters;

c) state of human health and safety, human living conditions, state of cultural facilities and constructions to the extent they are affected or may be affected by the state of the environmental elements or through these elements, factors, activities and measures indicated in sub-clause b) above.

Thus, international legislation sees evaluation of environmental impact, monitoring and study of likely adverse impact of the plant operation and extensive public discussion of the said matters as its top priority.

In the same time, maintaining a high level and constant enhancement of nuclear, radiation and environmental safety, as well as environmental protection, are the South-Ukraine NPP's major aspects of activity. Continuous monitoring of radioactive releases and discharges into the environment, examination of water, bottom sediment, ground, plants, air and precipitation for radioactive nuclei concentrations is carried out as part of this activity.

These observations throughout the SU NPP time of operation are reflected in annual reports. In particular, information on the state of radiation safety and antirad protection at SU NPP can be found in the "Plant Radiation Safety Reports", and the non-radioactive impact monitoring results – in the "Non-radioactive Factor Impact Reports".

Considering the requirements of Ukrainian and international legislation in relation to the SU NPP Unit 1 lifetime extension, a set of documents and materials on the assessment of Unit 1 lifetime extension environmental impact have been compiled, including:

- Periodic Safety Review Report (Section 14 «Environmental Impact Evaluation»);
- Environmental audit of SU NPP power units;
- Environmental assessment of the Comprehensive (Integrated) Safety Improvement Program for the Power Units of Ukraine NPPs;
- National Report of Ukraine «Stress-tests results»;
- Other materials in accordance with the list attached.

## 3. Materials and documentation regarding assessment of the impact of SU NPP#1 operation life extension on the environment

### 3.1 Periodic Safety Review Report. Safety factor №14. Environmental effect of NPP operation.

Due to expiration of SU NPP#1 design operation life in 2012 operating organization SE NNEGC "Energoatom" and DS SU NPP consider a possibility to extend NPP power units operation lifetime. The basic document on the basis of which an approved decision is to be made regarding extension of NPP license validity for operation beyond design basis is «Periodic Safety Review Report» (further - PSRR).

Within PSRR it has been performed an analysis of 14 safety factors (SF), which are grouped according to chapters each of which is presented as an individual report. Upon the evaluation results of all safety factors, comprehensive safety analysis was performed which is also drawn up as an individual report.

SF-14 chapter is the report «Environmental effect of NPP operation.» [7]. Its task include the following aspects:

– Description of the radiation monitoring system of SU NPP impact on the environment, of the implemented measures related to the upgrading of this system, provision of information regarding actual impact of NPP on the environment upon the monitoring results;

– - a comparative analysis of the results of an actual impact of SU NPP on the environment with the established limits;

– - provision of information regarding activities aimed at the decrease of radiation effect of NPP on the environment and about the lack of preconditions for the excess of the established limits in beyond design operation period.

The report is made according to «Technical guideline on PSRR production», EP 03-2009.410.ОД.01, approved by DS SU NPP and NNEGC "Energoatom" Main Office and it consists of the following sections:

1. Factor evaluation requirements
   - 1.1. National regulatory requirements
   - 1.2. International regulatory requirements and guidelines
2. Safety factor analysis
   - 2.1. Normative base, applicable to the current safety factor
   - 2.2. Evaluation methods
   - 2.3. Evaluation criteria
   - 2.4. Evaluation results
     - 2.4.1. The existing radiation environmental impact sources at SU NPP
     - 2.4.2. Maximum values of radionuclide releases and discharges under normal operating conditions of NPP power units in general
       - 2.4.2.1. Maximum values of radionuclide releases for DS SU NPP. Actual gas-aerosol releases of radioactive materials to the atmosphere of DS SU NPP during the period of operation
       - 2.4.2.2. Maximum values of radionuclide discharges for DS SU NPP. Actual discharges of radioactive materials to the DS SU NPP water facilities during operating period
     - 2.4.3. Program of surveillance over radiation environment in the controlled area. Automatic radiation condition monitoring system (ASKRO)
       - 2.4.3.1. Radiation monitoring program at DS SU NPP.
       - 2.4.3.2. Scope of environmental radiation monitoring performed at DS SU NPP
       - 2.4.3.3. Main information regarding the automatic radiation condition monitoring system (ASKRO) of DS SUNPP
     - 2.4.4. Radiation situation monitoring results in the NPP area. Sharing information with the public
       - 2.4.4.1. Radiation situation in the vicinity of South-Ukraine NPP (buffer area and radiation control area) during pre-commissioning period. "Zero background" monitoring
       - 2.4.4.2. Data on radiation situation in SU NPP area
         - Gamma-radiation dose rate monitoring in the locality
         - Monitoring of radionuclide content in surface air
         - Monitoring of radionuclide content in precipitations
         - Monitoring of radionuclide content in water bodies
         - Monitoring of radionuclide content in heat and water supply network
         - Water monitoring in radiation logging wells
         - Monitoring of radionuclide content in bottom sediments
         - Monitoring of radionuclide content in soil and vegetation
         - Monitoring of radionuclide content in agricultural products
       - 2.4.4.3. Sharing information with the public
     - 2.4.5. Conclusions

     Issues definition and ranking
3. Factor corrective activities

4. Evaluation of situation development by the next PSR
5. Conclusions

Upon the report results it has been concluded that radiation monitoring system has been implemented and it works properly at DS SU NPP. This system allows performing not only monitoring of environment parameters but also monitoring over a technological process and over spreading of radiation pollution. .

The measurement results of releases and discharges for the operating period show that actual levels of discharges and releases after purification plants are two times less than maximum values of releases and discharges regulated for DS SU NPP according to NRBU-97. Due to this fact radiation environment around DS SU NPP is at the level which was before the power units commissioning. A comparative analysis of the results of the investigation of air, water bodies, soil, vegetation and etc. for the period of SU NPP operation with the investigation results made before DS SU NPP construction.

Experience gained by the staff related to power unit operation with reactor facility B-302 as well as efficient technological process allow to confirm that there are no preconditions to increase actual values of releases and discharges later on.

DS SU NPP implements systematic measures for reduction of radiation impact on the environment in particular:

- the following programs are effective: PM.0.0026.0029 «Program for enhancement of radiation safety level and assurance of radiation protection of DS SU NPP» and program ALARA, implementation of the measures of which promote reduction of collective and individual doses for DS SU NPP staff and contracting organizations, stabilization and reducing rates of radioactive waste accumulation, lack of cases of excess of reference levels and basic dose limits and radiation accidents;
- «Program for minimization of radioactive waste at DS South-Ukraine NPP PM.0.0006.0003» is effective;
- in 2012 it was planned to put ASCRO system into commercial operation which allows to control radiation parameters of the environment in automatic.

### 3.2 Comprehensive (Integrated) Safety Improvement Program for NPP power units of Ukraine: Ecological assessment

«Comprehensive (Integrated) Safety Improvement Program for NPP power units of Ukraine (C(I)SIP) is approved by the Order of the Cabinet of Ministers dated 07.12. 2011 №1270. It is developed according to the Decree of the President of Ukraine 12.05.2011 №585 about introduction into effect a decision of National Security and Defense Council of Ukraine for safety issues of Ukrainian NPPs and perspectives of nuclear power industry development in Ukraine in the light of events at “Fukushima-1” NPP.

The goal of the program is:

– enhancement of safety level of nuclear power plant units operation and their reliability;

– decrease of accident risks at the nuclear power plants during natural disasters or other extreme cases;

– enhancement of efficiency of management of design basis and beyond design basis accidents at nuclear power plants, minimization of their consequences.

The developers of C(I)SIP work papers were PJSC «Kyiv Research and Development Institute «Energoproekt» and OJSC «Kharkiv Research and Development Institute «Energoproekt».

In order to ensure meeting the requirements of environmental protection and ecological safety of C(I)SIP Ecological Assessment (EA) was performed ensuring its further publishing and discussion of EA report within public consultation process and its updating upon public discussion results.

Herewith due to the fact that C(I)SIP envisages safety enhancement at all four existing NPPs without construction of a new NPP or capacity increase EA of C(I)SIP is not completely subject to the requirements of state building norms as for impact assessment on the environment for new facilities. EA process was regulated by the normative document developed for this specific case.

Records of EA of C(I)SIP which directly concern SU NPP are included into Chapters 5, 6 of the report [8] and consist of the following sections:

5 EA of the results of C(I)SIP at South-Ukraine NPP

5.1 General characteristics of NPP

5.1.1 Region and place of location of NPP site

5.1.2 Brief characteristics of South-Ukraine NPP operation and its hazard classes

5.1.3 Brief characteristics of South-Ukraine NPP output.

5.1.4 Information about raw material, soil, water, power and other resources used

5.1.5 Brief description of NPP technological process

5.1.6 C(I)SIP measures aimed at the elimination or reduction of harmful releases, discharges, leakage and radiation emission into the environment

5.1.7 Brief description of the scheme of spent fuel handling. Spent fuel volume.

5.1.8 Brief description of the scheme of radioactive waste handling. Radioactive waste volume.

5.1.9 Brief description of the scheme of handling of harmful and industrial waste. Scope of harmful and industrial waste.

5.1.10 C(I)SIP measures aimed at waste reduction and improvement of waste handling activities.

5.1.11 Brief description of the analyzed design basis and beyond design basis accidents.

5.1.12 Brief description of the design solutions reducing risks or mitigating accident consequences (without taking into account C(I)SIP measures)

5.1.13 C(I)SIP measures aimed at the reducing risks or mitigating accident consequences

5.1.14 Buffer and radiation control area

5.2 Evaluation of an impact on the environment

5.2.1 Climate and microclimate

5.2.2 Aerial environment

5.2.3 Geological environment

5.2.4 Water environment (underground waters, open water reservoirs)

5.2.5 Soil and topograpgy

5.2.6 Flora and fauna, wildlife sanctuaries

5.3 Evaluation of an impact on social environment

5.3.1 Brief characteristics of the existing state within the radiation control area

6.2 Change in assessment results resulting from C(I)SIP implementation

6.3 Measures related to sharing information with neighbouring states regarding possible impact of C(I)SIP implementation in a transboundary context

### 3.3 National report of Ukraine «Stress test results»

After a severe accident which took place on 11 March 2011 at Fukushima-1 NPP (Japan) the European Council declared that the safety of European NPPs should be reviewed on the basis of a comprehensive risk assessment. The European Nuclear Safety Regulators Group (ENSREG) and the European Commission agreed technical requirements for stress tests. The task of the stress tests was a detailed analysis of extreme natural events and their combinations that may challenge the plant safety functions and may cause a severe accident.

State Nuclear Regulatory Inspectorate of Ukraine in cooperation with State Inspectorate of Technogenic Safety and NNEGC «Enegoatom» developed Action Plan regarding targeted reassessment of the safety condition and further safety enhancement of Ukrainian NPPs in the light of events which occurred at Fukushima-1. According to the Plan a targeted additional reassessment of the safety condition of all operating power units of Ukrainian NPPs was implemented.

Stress test results are reflected in National report of Ukraine produced by State Nuclear Regulatory Inspectorate [9]. Part 1 of the mentioned report «Operating NPPs of Ukraine» consists of sections related to SU NPP:

1. General data on the sites and Nuclear Power Plants of Ukraine

1 SU General data on the South Ukraine NPP

2. Землетруси

3. Flooding

3 SU Flooding (South Ukraine NPP)

4. Extreme weather conditions
5. Loss of electrical power and loss of ultimate heat sink
6. Severe accident management.
7. General conclusions.

### 3.4 SU NPP ecological audit report

In addition to the above said ecological evaluations under the C(I)SIP and stress-tests, an ecological audit was conducted at SU NPP over the period September 2011 – January 2012. Its purpose was to define the ecological justification and an operating efficiency of South Ukraine power units during their lifetime extension, to confirm the compliance of the lifetime extension activity with the Environment Protection Law.

The audit client is South-Ukraine NPP, the responsible executor – the State-owned Enterprise “State Scientific and Engineering Center for Monitoring and Emergency Response Systems”, Kyiv. Experts from the Ukrainian Scientific Research Institute of Ecological Problems, Kharkiv; the Training and Scientific Institute for Ecological Safety and Management of the State Ecological Academy of Postgraduate Education and Management by the Ministry of Ecology of Ukraine (Kyiv) and the Laboratory of Radio-

ecological Reliability of Biosystems of the Insitute of Cellular Biology and Genetic Engineering of the National Academy of Sciences, Kyiv, made their contribution to this work.

In addition to the general information, the "SU NPP ecological audit report" [10] contains the following data:

2 GENERAL CHARACTERISTIC OF SOUTH-UKRAINE POWER UNITS
- 2.1 The main design characteristics and operating parameters
  - 2.1.1 Brief description of the power units and processes
  - 2.1.2 Environmental impact factors
  - 2.1.3 List of potential environmental impact sources
    - 2.1.3.1 Thermal impact
    - 2.1.3.2 Chemical impact
    - 2.1.3.3 Radiological impact
  - 2.1.4 List of potential impact objects and impact zone boundaries during SU power units operation
  - 2.1.5 Brief description of a spent fuel handling diagram. Spent fuel volumes
  - 2.1.6 Design data about design volumes of gaseous, liquid and solid radwaste production, other hazardous and general industrial wastes
  - 2.1.7 Brief description of design decisions on radwaste handling, other hazardous and general industrial wastes
    - 2.1.7.1 Liquid radwaste handling during SU power units operation
    - 2.1.7.2 Solid radwaste handling during SU power units operation
    - 2.1.7.3 Hazardous and general industrial waste handling during SU power units operation
  - 2.1.8 Potential accidents during SU power units operation and characteristics of their impact upon the environment
    - 2.1.8.1 List of potential accidents during SU power units operation
    - 2.1.8.2 SU NPP emergency plan
    - 2.2 Current systems for control and integrated monitoring of SU power units operation
    - 2.3 Recorded emergencies, their level according to the INES
  - 2.3.1 Statistics of SU NPP occurrences
  - 2.3.2 Analysis of events according to the INES
- 2.4 List and a brief summary of safety upgrading measures
  - 2.4.1 Radiation Safety Level Upgrading and Radiation Protection Assurance Programme
  - 2.4.2 Comprehensive Ukrainian NPPs Safety Upgrading Programme
  - 2.4.3 Stress-tests

Conclusions based on the information given in Section 2

3 CHARACTERISTIC OF SOUTH-UKRAINE POWER UNITS AS THE ENVIRONMENTAL IMPACT OBJECTS
- 3.1 Characteristic of environmental impact sources
  - 3.1.1 Current SU NPP environmental radiation impact sources
- 3.2 Characteristic of environmental impact factors and impact types
  - 3.2.1 Airborne radioactive releases into the atmosphere
  - 3.2.2 Discharge

Based on the results of the SU NPP ecological audit the following conclusions are made:

- Over the period of its operation SU NPP doesn't reveal any detectable negative effect upon the environment;
- SU NPP activity meets the current Ukrainian Environmental Protection Law completely;
- Measures implemented by SU NPP to protect the environment are to be considered effective, comprehensive and justified ones, and SU NPP environmental protection activity is to be considered rather effective and sufficient to a great extent;
- Environmental management system that is in place at SU NPP is rather effective.

All the above preconditions allow us to make the conclusion that it can be possible to extend the SU NPP lifetime under normal operating conditions without significant negative impact upon the environment.

## 4. Assessment of a potential transboundary environmental impact of the SU NPP-1 lifetime extension

The Convention on an assessment of a potential transboundary environmental impact of the SU NPP-1 lifetime extension defines the Countries' obligations in terms of an assessment of a set of activities upon the environment. It also assigns the general requirements to the Countries to inform and consult each other regarding the major projects that can have a significant negative effect upon the neighboring countries.

Among all the types of the SU NPP transboundary impacts the only type that could be accounted as a significant one to some extent one can consider the radiation impact. The data on the dynamics of atmospheric precipitation density change, given in [7, 10], over the whole period of radial surveillance zone and the dynamics of some radionuclide concentration change show that $^{90}Sr$, $^{137}Cs$, $^{134}C$, $^{60}Co$, $^{54}Mn$ radionuclide concentrations in air samples and atmospheric precipitation in the surveillance zone are within the limits measured before SU NPP commissioning.

That is, SU NPP impact upon the atmospheric environment over its operation period hasn't been significant even for the surveillance zone. Taking into account the fact that with the distance from the emission source the density of radionuclide pollution of the territory reduces significantly, under normal operating conditions even in terms of the nearest neighbouring countries such as the Republic of Moldova (the distance from SU NPP to its border is ~ 130 km) and Romania (~ 250 km), there are no reasons to consider a significant hazardous transboundary impact resulted from the SU NPP-1 lifetime extension.

Similar conclusions are made in the Report [8] stating that radiation, chemical and physical impact of the all Ukrainian four NPPs under normal operating conditions upon the environment, social environment and technological environment is limited to the satellite towns and the NPP 30-km surveillance zone.

The brief description of the analyzed design basis and beyond design basis accidents is given in par. 2.1.8.1 of the Report [10].

The document [8] gives a description of design decisions that reduce the risk or mitigate accident consequences excluding measures stated in the C(I)SIP as well as the C(I)SIP measures aimed at risks reduction and accident consequences mitigation.

The location of SU NPP site and an expected level of ecological impacts as a result of the SU NPP-1 lifetime extension lead to the conclusion that there is no need in detailed informing and consultations with the neighbouring countries. That is why it is planned to release online an explanatory note and information & analytical review of information related to an assessment of the SU NPP-1 lifetime extension impact upon the environment in English and Ukrainian for the public familiarization. It will be sufficient for dissemination of the information about the transboundary impact.

The information & analytical review will be developed to meet the requirements of the abovesaid Conventions that stipulate making of a "non-technical summary" (Appendix II, par.i ESPOO Convention), or a "popular summary" (Article 6, par.6 Aarhus Convention)

## CONCLUSION

Considering the conclusions made on the basis of the abovesaid information on the environmental impact evaluation with respect to SU NPP-1 lifetime extension it is

possible to state that the SU NPP lifetime extension activity consists of the following significant components:

- this activity does not change the current design;
- power unit capacity stays steady;
- this activity doesn't envisage to increase the energy production volume;
- environmental impact doesn't increase.

The SU NPP-1 lifetime extension doesn't result into significant changes in the previous activity related to its operation.

## References

1. Decree No. 145-r of the Cabinet of Ministers of Ukraine «On the Approval of the Energy Strategy of Ukraine for the Period by 2030» dated 15 March 2006;
2. Law of Ukraine No. 2861–IV "On the Order of Decision Making with respect to Siting, Design, Construction of Nuclear Installations and Radwaste Management Facilities of National Importance" dated 8 June 2005;
3. Law of Ukraine No. 1566-VI "On the Amendments to the Law of Ukraine "On the Order of Decision Making with respect to Siting, Design, Construction of Nuclear Installations and Radwaste Management Facilities of National Importance" dated 25 June 2009;
4. Law of Ukraine No. 1906-IV "On International Treaties" dated 29 June 2004;
5. Law of Ukraine No. 534-XIV "On the Ratification of Convention on Environmental Impact Assessment in a Transboundary Context" dated 19 March 999;
6. Law of Ukraine No. 832-XIV "Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters" dated 6 July 1999;
7. "South-Ukraine NPP. Power Unit №1. Periodic Safety Review Report. Safety Factor №14. Environmental effect of NPP operation". 2010.
8. "Comprehensive (Integrated) Safety Improvement Program for power units of Ukrainian NPPs: Ecological Assessment». SE NNEGC "Energoatom", 2011.
9. State Nuclear Regulatory Inspectorate of Ukraine. National Report of Ukraine "Stress Test Results". 2011 .
10. "SU NPP Ecological Report Звіт", State Scientific Engineering Center of Control Systems and Emergency Response, Ministry of Energy and Coal Industry of Ukraine, Kyiv, 2012.

## List of materials to the environmental impact evaluation with respect to SU NPP Unit 1 lifetime extension

| | |
|---|---|
| 1 | Periodic Safety Review Report (chapter 14 “Evaluation of impact on the environment”) |
| 2 | Ecological audit of SU NPP power units |
| 3 | Ecological evaluation of Comprehensive (Integrated) Safety Improvement Program for SU NPP power units |
| 4 | National Report of Ukraine “Stress test results” |
| 5 | Safety Analysis Report. Analysis of the design-basis accidents. |
| 6 | Additional materials for safety analysis. Book 3 “Impact of NPP on the environment” |
| **Documents of SE NNEGC “Energoatom”** | |
| 7 | PL-S.0.06.003-10 Regulation on organizational structure of SE NNEGC “Energoatom”, approved by the President of SE NNEGC “Energoatom” on 19.04.2010 |
| 8 | PM-D.0.03.195-07 Program of nature-oriented activities of SE NNEGC “Energoatom” |
| 9 | PM-D.0.05.174-08 Program of NNEGC “Energoatom” on radioactive waste handling |
| 10 | PL-D.0.26.347-05 Regulation on administrative and technological levels of radiation parameters at NPP |
| 11 | PL-D.0.03.055-07 Regulation on consolidated annual report for evaluation of the current level of operational safety status for NPP units with WWER |
| 12 | PL-K.0.18.005-03 Regulation on staff management in SE NNEGC “Energoatom” |
| 13 | Plant Standard (STP) 0.06.012-2001 Requirements to quality system. Personnel training and qualification. |
| 14 | STP 0.06. 015-2001 Requirements to quality system. Performance of work |
| 15 | STP 0.26.040-2002 Control levels of radiation parameters at the nuclear power plants (radiation and hygienic parameters of the first group). General rules for level establishing. Procedural guidelines |
| 16 | STP 0.06.038-2003 Production control. Modification, modernisation, technical re-equipping. General provisions |
| 17 | STP 0.03.051-2004 Solid radioactive waste. Determination of activity and isotope composition. General provisions |
| 18 | STP 0.03.059-2005 Control levels of waste generation at the nuclear power plants. Procedural guidelines on their establishing |
| 19 | STP 0.03.065-2006 Determination of effective external exposure dose for NPP personnel. Procedural guidelines |
| 20 | STP 0.20.062-2006 Procedure on radiation dose planning for personnel, involved in elimination of the accident consequences. General requirements |
| 21 | STP 0.20.063-2006 Procedure on personal radiation monitoring of external and internal exposure in accident conditions |
| 22 | STP 0.41.066-2006 System of assessment of operational safety level and technical state for nuclear power plants with water-moderated water-cooled power reactors. General requirements |
| 23 | STP 0.03.064-2007 Determination of effective internal exposure dose for NPP personnel on the basis of biophysical measurements. Procedural guidelines |
| 24 | STP 0.26.085-2009 Ensuring environmental safety. Requirements to format and content of the reports of detached subdivisions of SE NNEGC “Energoatom” on assessment of NPP non-radiation factor impact on the environment |
| 25 | SOU-N YaEK 1.026:2010 Organization and performance of nature-oriented activities and nature management in the detached subdivisions. |

| Documents of Environmental Protection Department (EPD), DS "South-Ukraine NPP" | |
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| 26 | Inspection certificates of water intake which is located on the fishery pond, 2011 |
| 27 | Sphere of qualification for ecological and chemical laboratory, EPD, Internal Supervision and Fire Safety Service to perform measurements in the field of the state metrological supervision. Annex to qualification certificate No.YU-4/9-57-4 dated 14.07.2010 |
| 28 | Report on implementation of the Program for interlaboratory comparison of measurement data of mass pollutant concentration in environmental medium. – UkrNDIEP, 2010 |
| 29 | Procedure on non-radioactive waste handling at SU NPP, IN. 0.3708.0079, approved by the Chief Engineer of SU NPP on 16.06.2009 |
| 30 | Letter of Ministry of Environmental Protection of Ukraine No.1493/09/37 concerning permit for chemical substances handling (sulfuric acid, nitric acid, sodium hydroxide, ammonium hydroxide and sodium hydrogen sulfite) dated 30.04.2009 |
| 31 | Chemical control scope for surface water, RG.0.3708.0114, approved by the Chief Engineer of SU NPP dated 14.10.2010 |
| 32 | Chemical control scope for process water, RG.0.3708.0083, approved by the Chief Engineer of SU NPP on 20.05.2009 |
| 33 | Instrumental monitoring scope for stationary sources of pollutants emission to the atmospheric air, RG.0.3708.0104, approved by the Chief Engineer of SU NPP on 20.05.2009 |
| 34 | Evaluation report on the impact of SU NPP non-radiation factors on the environment within the period of 2009 |
| 35 | Evaluation report on the impact of SU NPP non-radiation factors on the environment within the period of 2010 |
| 36 | Report (Form 2-TP) (water management) on water use by SU NPP (Alexandrovka Hydropower Plant) during the fourth quarter of 2010 |
| 37 | Report (Form 2-TP) (water management) on water use by SU NPP (Tashlyk Pumped Storage Plant) during the fourth quarter of 2010 |
| 38 | Report (Form No.1) "Waste handling" at SU NPP within the period of 2010 |
| 39 | Report (Form No.1) "Waste handling" at SU NPP within the period of 2010 (recreation center "Druzhba") |
| 40 | Passport of the laboratory of Water & Sewerage and Heat Supply Networks Department, PS.0.0300.0212 dated 23.09.2010 *Folder:* |
| 41 | Passport of ecological and chemical laboratory, PS.0.3708.0150 dated 22.06.2010 |
| 42 | Regulation of the laboratory of Water & Sewerage and Heat Supply Networks Department PL.0.0300.0210 dated 14.06.2010 *Folder:* |
| 43 | Regulations on Environmental Protection Department, PL.0.3708.0063, approved by the Director General of SU NPP on 12.04.2011 |
| 44 | Regulation on ecological and chemical laboratory, PL.0.3708.0106 dated 14.06.2010 |
| 45 | Procedure of surveillance and actions of EDP staff during the period of spring flood. Procedure, IN.0.3708.0103 dated 05.08.2010 |
| 46 | Maximum permissible discharge (MPD) of substances into the water body (Yuzhny Bug) with return water of SU NPP (process water of Alexandrovka Hydropower Plant), approved on March 15, 2009 for the period until 15.03.2012 |
| 47 | Maximum permissible discharge (MPD) of substances into the water body (Yuzhny Bug) with return water of SU NPP (SU NPP blowdown water), approved on 15.03.2009 for the period until 15.03.2012 |
| 48 | Special water use permit No. UKR 3068 A/NIK for Detached Subdivision "SU NPP", approved on 18.03.2010 for the period until 15.03.2012 |
| 49 | Special water use permit No. UKR 3069 A/NIK for Alexandrovka Hydropower Plant, DS "SU NPP", approved on 18.03.2010 for the period until 15.03.2012 |
| 50 | Special water use permit No. UKR 3067 A/NIK for Tashlyk Pumped Storage Plant, |

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| | approved on 18.03.2010 for the period until 15.03.2012 |
| 51 | Special water use permit No. UKR 2346 A/NIK for SU NPP Water & Sewerage and Heat Supply Networks Department, approved on 27.11.2006 for the period until 27.11.2011 |
| 52 | Permit No. 04.11/11 dated 12.07.2010 for SU NPP waste emplacement in 2011 for the period until 31.12.2011 (issued by recreation center "Druzhba") |
| 53 | Permit No. 21.06/11 dated 13.07.2010 for SU NPP waste emplacement in 2011 for the period until 31.12.2011 |
| 54 | Permit No. 09/295, dated 13.03.2008 to store and use ammonia for the period until 27.03.2011 |
| 55 | Permit No. 09/344 dated 02.12.2008 to store and use hydrazine hydrate for the period until 03.12.2011 |
| 56 | Permit No. 09/294 dated 13.03.2008 to store and use sodium hydroxide for the period until 16.03.2011 |
| 57 | Permit No. 09/402 dated 20.12.2010 to store and use morpholine for the period until 30.08.2013 |
| 58 | Procedure on SU NPP Tashlyk cooling pond blowdown into Alexadrovka reservoir, RG.0.3708.0113, approved by the Chief Engineer of SU NPP on 13.09.2007 |
| 59 | Ecological and chemical laboratory guideline on quality, RK.0.3708.0107 dated 04.06.2010 |
| 60 | Process procedures for SU NPP water purification plant (WPP-2), RG.0300.0004.0006 dated 21.02.2005 |
| 61 | Procedure for personnel actions in case of exceeding the permissible content of hazardous substances in the waste water discharged into the site industrial and storm water drain system, RG.0.3708.0030, approved by the Chef Engineer of SU NPP on 06.10.2011 |
| 62 | Qualification certificate of ecological and chemical laboratory, EPD, SU NPP, registration No. YU-4/9-57-4 dated 15.07.2010 valid before 15.07.2015 |
| 63 | Draft waste generation and emplacement limits for SU NPP in 2011, approved by the Deputy Chairman of the state administration in Nikolayev region, 28.07.2010 |
| 64 | Long-term plan of activity in the field of waste handling, aimed at preventing or reducing volume of waste and negative impact on the environment and human health, approved by the Director General of SU NPP on 30.04.2010 |
| **Documents of Occupational Safety Department (OSD), DS "South-Ukraine NPP"** | |
| 65 | Regulation on occupational safety management system in DS "SU NPP", PL.0.0029.0020 dated 17.08.2006 |
| 66 | Regulation on SU NPP staff training, briefing and examination on occupational safety issues, PL.0.0055.0104 dated 22.03.2010 |
| 67 | Appendix 9, fourth quarter, 2010 "Information on occupational safety inspections and measures taken to violators within the fourth quarter and twelve months of 2010" |
| 68 | Appendix 1, fourth quarter, 2010 "Information on implementation of Complex organizational and technical measures during 12 months of 2010 that are included in the collective agreement with respect to occupational safety" |
| 69 | Appendix 6 "Non-occupational injury rate" |
| **Documents of Public Relations and Mass Media Department (PR&MMD), DS "South-Ukraine NPP"** | |
| 70 | Press-fact, October. Articles, comments of specialists, information about SU NPP and nuclear power industry in Ukraine, reviews of the most interesting articles in press and reports of International Nuclear News Agency – all the data are in news bulletins for mass media and population. – Yuzhnoukrainsk, 2011 |

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| 71 | Regulation on the procedure of public and mass media informing about the events related to SU NPP operation, PL.0.3404.0070 dated 21.12.2009 |
| 72 | Regulation on Public Relations and Mass Media Department, PL.0.3404.0045, approved by the Director General of SU NPP on 15.09.2010 |
| 73 | SU NPP Reporter No.82, November 9, 2011 |
| 74 | Report of PR&MMD on public relations during 2008 |
| 75 | Report of PR&MMD on public relations during 2009 |
| 76 | Report of PR&MMD on public relations during 2010 |
| 77 | "Energetik", the newspaper of SU NPP staff, No.44 (1400), Friday, November 4, 2011 |
| 78 | "Newsletter" of SU NPP management, issue No. 2, September 2011 |
| 79 | Brochure "South-Ukraine NPP and the environment", Yuzhnoukrainsk, 2010 |
| 80 | Brochure "South-Ukraine NPP and the environment", Yuzhnoukrainsk, 2011 |
| 81 | Brochure "Results of the plant operation during 2010", DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 82 | Brochure "Results of the plant operation during 2010", DS "South-Ukraine NPP", Yuzhnoukrainsk, 2010 |
| 83 | Informational leaflet "What is radiation", DS "SU NPP", Yuzhnoukrainsk, 2011 |
| 84 | Informational leaflet "South-Ukraine NPP", DS "SU NPP", Yuzhnoukrainsk, 2011 |
| 85 | SU NPP Reporter No. 83, November 9, 2011 – DS "South-Ukraine NPP" |
| 86 | Hardcopies of radio broadcast "FM-SU NPP News" dated 21.06.2011, 08.02.2011, 18.01.2011, 07.06.2011 |
| 87 | SU NPP Reporter mailing list for 2011 |
| 88 | Publications of "Reporters" on websites |
| 89 | Brochure "Press-fact", January, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 90 | Brochure "Press-fact", September, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 91 | Brochure "Press-fact", March, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 92 | Brochure "Press-fact", April, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 93 | Brochure "Press-fact", June, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 94 | Brochure "Press-fact", July, DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 95 | Staff memo on radiation safety and adherence to the principles of staff exposure dose optimization at SU NPP", DS "South-Ukraine NPP", Yuzhnoukrainsk, 2011 |
| 96 | Collected articles. Yuzhnoukrainsk; Printing office of DS "South-Ukraine NPP", 2011. – 68 pages |
| **Documents of Quality Service, DS "South-Ukraine NPP"** | |
| 97 | Quality system. Organizational structure of management. Area distribution among the plant management. Regulation PL.0.3202.0001, approved by SU NPP Director General on 11.04.2011 |
| 98 | Guideline on quality when handling radioactive waste, RK.0.0006.0065, approved by the Director General of SU NPP on 07.02.2011 |
| 99 | Guideline on quality when handling ionizing radiation sources, RK. 0.0026.0030, approved by the Chief Engineer of SU NPP on 26.06.2007 |
| 100 | Quality guideline for laboratory of personal radiation monitoring, radiometry, spectrometry and whole-body counter, RK.0.0026.0129, approved by SU NPP Chief Engineer on 26.08.2010 |
| 101 | Quality guideline for laboratory of external dosimetry, RK.0.0026.0122, approved by SU NPP Chief Engineer on 24.07.2009 |
| 102 | Quality guideline, RK.0.3202.0004, approved by SU NPP Chief Engineer on 16.07.2010 |
| 103 | Quality assurance in the area of «Radiation safety at SU NPP" Regulation PL.0.0026.0147, approved by the Chief Engineer of SU NPP on 17.04.2009 |
| 104 | Safety assurance. Safety culture. Guideline on organizing the activities – safety culture. |

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| | RU.0.3202.0029, approved by the Director General of SU NPP on 02.08.2011 |
| 105 | General quality guideline of Detached Subdivision "South-Ukraine NPP", RK. 0.3202.0023, approved by SU NPP Director General on 23.11.2010 |
| 106 | Quality system. Organizational structure of management. Area distribution among the plant management. Regulation PL.0.3202.0001, approved by SU NPP Director General on 11.04.2011 |
| **Documents of Emergency Preparedness and Response Office, Detached Subdivision "South-Ukraine NPP"** | |
| 107 | PN.0.0040.0011 Emergency plan of DS "South-Ukraine NPP". Part I, approved by the Director General of SU NPP on 08.06.2010 |
| 108 | PN.0.0040.0011 Emergency plan of DS "South-Ukraine NPP". Part II. Action cards, approved by the Director General of SU NPP on 08.06.2010 |
| 109 | PN.0.0040.0011 Emergency plan of DS "South-Ukraine NPP". Part III. Appendix, approved by the Director General of SU NPP on 08.06.2010 |
| 110 | Order No. 771 dated 12.07.2011 "On implementation of the emergency plan of DS "South-Ukraine NPP" |
| 111 | SU NPP buffer area plan |
| 112 | SU NPP 30 km zone plan |
| 113 | Regulation for personnel actions in case of radiation accident. Procedure IB.0.0026.0100, approved by the Director General of SU NPP on 16.09.2009 |
| 114 | PL.0.0040.0007 Regulation on the procedure of warning and operational message transfer in case of troubles in operation or emergency situations at SU NPP, approved by the Director General of SU NPP on 19.07.2011 |
| 115 | PL.0.0040.0016 Regulation on Emergency Preparedness and Response Office, approved by the Director General of SU NPP on 17.09.2010 |
| **Documents of Radwaste Processing Department, DS "South-Ukraine NPP"** | |
| 116 | PM.0.0006.0003 Program of radioactive waste minimization in the DS "South-Ukraine NPP", approved by the President of SE NNEGC "Energoatom" on 12.05.2009 |
| 117 | PL.0.0006.0034 Regulation on the procedure for radioactive waste handling dated 24.01.2011, approved by the Chief Engineer of SU NPP |
| 118 | IN.0.0006.0049 Solid radioactive waste handling. Job instruction, approved by the Chief Engineer of SU NPP on 08.09.2009 |
| 119 | NR.0.0006.0111 Norms of floor drain water and liquid radwaste generating in SU NPP subdivisions, approved by the Chief Engineer of SU NPP on 28.01.2009 |
| 120 | IN.0.0006.0069 Control levels of radwaste generating, approved by the Chief Engineer of SU NPP on 17.04.2009 |
| **Documents of Radiation Safety Department (RSD), DS "South-Ukraine NPP"** | |
| 121 | Personal radiation monitoring. Procedure IN.0.0026.0052, approved by the Deputy Chief Engineer (DCE) for nuclear and radiation safety of SU NPP on 26.06.2009 |
| 122 | Gamma land survey of radiation control area and buffer area. Procedure IN.0.0026.0024, approved by the DCE for nuclear and radiation safety of SU NPP on 30.04.2010 |
| 123 | RG.0.0026.0159 Permissible gas and aerosol release and permissible water discharge of radioactive materials to the SU NPP environment (radiation and hygienic procedure of the first group), approved by the Director General of SU NPP on 19.10.2011 and endorsed by the Ministry of Health of Ukraine on 03.10.2011 |
| 124 | RG.0.0026.0035 Reference levels of emissions and discharges of radioactive substances to the environment and exposure dose control levels for SU NPP personnel of category "A" (radiation and hygienic procedure of the first group), approved by the Chief Engineer of SU NPP on 29.10.2009 and endorsed by the Ministry of Health of Ukraine |
| 125 | General rules for measuring the environment sample activity on health-monitoring and |

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| | radiometric installations. Procedure IN.0.0026.0002 |
| 126 | Environmental sampling in the vicinity of SU NPP. Procedure IN.0.0026.0004, approved by the DCE for nuclear and radiation safety of SU NPP on 05.05.2010 |
| 127 | PS.0.0026.0170 Passport of the laboratory of external dosimetry, approved by the Director General of SU NPP on 27.04.2011 |
| 128 | PS.0.0026.0126 Passport of the laboratory of personal radiation monitoring, radiometry, spectrometry and whole-body counter (WBC), approved by the Chief Engineer of SU NPP on 10.02.2011 |
| 129 | PL.0.0026.0113 Regulation on the laboratory of external dosimetry, approved by the Director General of SU NPP on 10.07.2008 |
| 130 | PL.0.0026.0131 Regulation on the laboratory of personal radiation monitoring, radiometry, spectrometry and WBC, approved by SU NPP Director General on 14.11.2007 |
| 131 | PL.0.0026.0072 Regulation on Radiation Safety Department, approved by the Director General of SU NPP on 24.03.2008 |
| 132 | Procedure for registration and accounting of ionizing radiation sources. Procedure IN.0.0026.0152, approved by the Chief Engineer of SU NPP on 09.06.2010 |
| 133 | Environment sample preparation. Procedure IN.0.0026.0005, approved by the DCE for nuclear and radiation safety of SU NPP on 09.04.2011 |
| 134 | IN.0.0026.0052 Appendix B (obligatory one) Form of the personal radiation dose card for the staff of category “A” |
| 135 | PM.0.0026.0001 SU NPP ALARA Program. Part I. Some aspects of ALARA principles application in nuclear industry, approved by the Chief Engineer of SU NPP on 09.11.2010 |
| 136 | PM.0.0026.0001-02 SU NPP ALARA Program. Part II. Radiation protection control in the DS “SU NPP”, approved by the Chief Engineer of SU NPP on 05.11.2010 |
| 137 | PM.0.0026.0001-03 SU NPP ALARA Program. Part III. Analysis of radiation situation in DS “SU NPP” during 1983-2010 |
| 138 | Radiation safety in the DS “SU NPP”, Procedure IB.0.0026.0091, approved by the Chief Engineer of SU NPP on 25.02.2009 |
| 139 | Procedure for radiation monitoring in the DS “SU NPP”, approved by the Director General of SU NPP on 29.01.2010 |
| 140 | PM.0.0026.0029 “Program for increasing the radiation safety level and providing SU NPP radiation protection” |
| 141 | Regulation for personnel actions in case of radiation accident. Procedure IB.0.0026.0100, approved by the Chief Engineer of SU NPP on 16.09.2009 |
| 142 | Qualification Certificate of the laboratory of personal radiation monitoring, radiometry, spectrometry and WBC, SU NPP Radiation Safety Dprt., Registration No YU-8/8-53-2, issued by the Principle Metrological Service Organization of the SE NNEGC “Energoatom” on 13.03.2008, which is valid before 13.03.2013 |
| 143 | Qualification Certificate of the external dosimetry laboratory, SU NPP Radiation Safety Department, Registration No. YU-2/9-57-3, issued by the Principle Metrological Service Organization of the SE NNEGC “Energoatom” on 09.11.2009, which is valid before 09.11.2014 |
| 144 | SU NPP order No. 1041 dated 08.09.2010 “About assignment of persons responsible for radiation safety and radiation monitoring” |
| 145 | Act No. 02-11 for inspection of activity of the laboratory of personal radiation monitoring, radiometry, spectrometry and WBC, SU NPP Radiation Safety Dprt., in the prescribed accreditation field, approved by the Executive Director for Operation, SE NNEGC “Energoatom” on 22.02.2011 |
| 146 | Act No. 01-11 for inspection of activity of the external dosimetry laboratory, SU NPP |

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| | Radiation Safety Dprt., in the prescribed accreditation field, approved by the Executive Director for Operation, SE NNEGC "Energoatom" on 22.02.2011 |
| 147 | Act No. YU-2/9-57-3 for verification of compliance of the external dosimetry laboratory, SU NPP Radiation Safety Dprt., with the criteria for measuring laboratory qualification, approved by the Executive Director for Operation, SE NNEGC "Energoatom" on 02.11.2009 |

# Revision Sheet

| Revision | Page number | | | | Pages in total | Notice designation | Date of notice registration | Signature | Date of revision |
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| | Revised | Replaced | New | Cancelled | | | | | |
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