StrålevernRapport 2001:4

Phase 1 of the Regulatory Lepse Project

Project Report, April 2001

Malgorzata K. Sneve, Norwegian Radiation Protection Authority
Curt Bergman, Swedish International Project
Magnus Westerlind, Swedish Nuclear Power Inspectorate
Irina Sokolova, Gosatomnadzor of Russian Federation
Valentin Markarov, Gosatomnadzor of Russian Federation

Gosatomnadzor - Federal Nuclear and Radiation Safety Authority of Russia

SWEDISH INTERNATIONAL PROJECT
Nuclear Safety

Statens strålevern

Statens strålevern
Norwegian Radiation Protection Authority
Østerås, 2001

Referanse:
Sneve M.K., Bergman C., Westerlind M., Sokolova I., Markarov V., Phase 1 of the Regulatory Lepse Project. Project report. Strålevern Rapport 2001:nr . Østerås: Statens strålevern, 2001.

Emneord:
Myndighetssamarbeid om sikkerhetsvurderinger. Utvikling av forskrifter med retningslinjer for sikkerhetsanalysen, kvalitetssikkrings programmet og til andre dokumenter knyttet til gjennomføring av Lepse prosjektet .

Resymé:
Informasjon om samarbeidet mellom vestlige og russiske strålevernsmyndigheter om prinsipper og retningslinjer for avfallshåndtering knyttet til Lepse prosjektet. Tre russiske retningsgivende forskrifter ble utviklet knyttet til gjennomføring av Lepse prosjektet.

Reference:
Sneve M.K., Bergman C., Westerlind M., Sokolova I., Markarov V., Phase 1 of the Regulatory Lepse Project. Project report. Strålevern Rapport 2001:nr . Østerås: Norwegian Radiation Protection Authority, 2001. Language: English.

Key words:
Authority cooperation on safety management for radioactive waste. Development of the regulatory guidance documents for safety analyses, quality assurance programme and other documents in connection to the Lepse project.

Abstract:
Information exchange between western and Russian nuclear safety authorities about the principles and guidance for radioactive waste management regarding the Lepse project. Three Russian guidance documents was developed connected to the implementation of the Lepse project.

Prosjektleder: Malgorzata Karpow Sneve.
Godkjent:

Erling Stranden, avdelingsdirektør, Avdeling Beredskap og sikkerhet.

121 sider.
Utgitt 2001-05-11
Opplag 250
Form, omslag: Graf, Oslo.
Trykk: Jebsen Trykk og Kopi A/S, Østerås.

Bestilles fra:
Statens strålevern, Postboks 55, 1332 Østerås.
Telefon 67 16 25 00, telefax 67 14 74 07.
E-post: postmottak@nrpa.no
Internett: www.stralevernet.no

ISSN 0804-4910

Preface

The Norwegian and Swedish governments have allocated funds to support upgrading of nuclear safety in the Russian Federation.

In Norway, the administration of the funds is entrusted to the Ministry of Foreign Affairs. Technical aspects are managed by the Norwegian Radiation Protection Authority (NRPA). The NRPA is project manager for many bilateral Norwegian-Russian projects in the area of nuclear safety and radioactive waste management.

In Sweden, the Government, through its Ministry of Foreign Affairs, has delegated to the Swedish Nuclear Power Inspectorate, (SKI), the responsibility to implement the program on upgrading the safety of nuclear installations in the Central and Eastern Europe and in the Russian Federation. The SKI is, in co-operation with the Swedish Radiation Protection Authority, (SSI), responsible for planning, implementing and follow-up of individual projects. For this purpose a special department at the SKI, the Swedish International Project Nuclear Safety (SIP), has been established. The SSI has a corresponding organisation called SSI International Development Co-operation, SIUS.

Following an old Nordic tradition, the safety authorities are co-operating also in giving supporting to the Russian Federation, and notably to its nuclear safety authority, RF Gosatomnadzor. The project described in this report is an example of such a co-operation where the specific experience and expertise of the two countries are effectively used to achieve better results than has been possible should they have been working separately.

Since the financial resources of the Norwegian and Swedish funds are limited, the financial support from the European Commission, through the DG-Environment, has been most welcome. It has enabled the implementation of specific tasks which otherwise could not have been carried out for financial reasons.

The constructive engagement by the RF Gosatomnadzor has been a very positive experience from this project. It has helped to bring this phase to a successful completion and provides a good start for the next phase, which is to grant the necessary license(s) and establish conditions for the implementation of the Industry Lepse Project.

Lars Gunnar Larsson
Director
Swedish International Project
Nuclear Safety

Torbjørn Norendal
Ambassadør
Norwegian Ministry of Foreign Affairs

Project Report: Phase 1 of the Regulatory Lepse Project

Table of contents

1. Introduction 8
2. The Regulatory Lepse Project 9
    2.1 Overall objective and work plan 9
    2.2 Objective and scope of RLP Phase 1 10
    2.3 Structure and organisation of RLP 11
3 Summary of activities in Phase 1 of RLP 11
4 Results of Phase 1 of RLP 13
    4.1 Introduction 13
    4.2 Requirements on a set and content of documents 13
    4.3 Requirements on a quality assurance program 14
    4.4 Requirements on a Safety Analysis Report 15
    4.5 Environmental Impact Assessment Report 16
5 Conclusions of RLP phase 1 16
6 Future activities within RLP 17
Acknowledgements 17
References 17
Appendices 18

Abbreviations and Acronyms

DG	Directorate General (of the European Commission)
EIA	Environmental Impact Assessment
IAEA	International Atomic Energy Agency
ILP	Industry Lepse Project
NRPA	Norwegian Radiation Protection Authority
QAP	Quality Assurance Programme
RLP	Regulatory Lepse Project
SAR	Safety Analysis Report
SEC-NRS	Scientific and Engineering Centre on Nuclear and Radiation Safety of RF Gosatomnadzor
SFA	Spent Fuel Assembly
SIP	Swedish International Project Nuclear Safety
SIUS	SSI International Development Co-operation
SKI	Swedish Nuclear Power Inspectorate
SNF	Spent Nuclear Fuel
SSI	Swedish Radiation Protection Institute

1. Introduction

The nuclear and environmental problems in the NorthWest Russia are closely related to the management of the spent nuclear fuel (SNF) and radioactive waste generated during the operation and decommissioning of marine nuclear installations. The Russian Federation is seriously concerned and takes a number of actions to improve the environmental situation. There is a large number of bilateral and multilateral co-operation projects established and under discussion to support the Russian efforts. One of these international co-operation projects is the retrieval of the SNF stored on board the storage ship Lepse, in this report called the Industry Lepse Project (ILP). The SNF on board Lepse is badly damaged and can therefore not be handled using normal procedures. The ship, located at Murmansk harbour, is also in a poor condition. Within the ILP a feasibility study has been performed demonstrating a technique, which could be used to safely remove the SNF. Mainly due to unsolved liability questions, the next phase of the ILP has not yet (as of March 2001) been initiated.

It is recognised that the implementation of the ILP will require application of a licensing procedure by the appropriate Russian authorities, primarily the RF Gosatomnadzor. It is further recognised that the timely implementation of the ILP requires a timely licensing process. The removal of the SNF from Lepse is a unique operation requiring a special approach for its regulation by the RF Gosatomnadzor. A further complication in the licensing is that there are possibilities for western technology involvement, not previously subject to RF Gosatomnadzor's review.

The Norwegian Radiation Protection Authority (NRPA) has a co-operation agreement with the RF Gosatomnadzor according to a protocol signed by the parties on 20 October 1997 [NRPA, 1997]. Sweden has a similar co-operation agreement on nuclear safety and radiation protection matters with the Russian Federation [Swedish Ministry of Environment, 1997]. The implementation of the Swedish agreement is delegated to the Radiation Protection Institute (SSI) and the Nuclear Power Inspectorate (SKI) on the Swedish side and to the RF Gosatomnadzor on the Russian side.

On the initiative of the NRPA, and with the support of the SSI and the SKI, represented by its Swedish International Project Nuclear Safety (SIP), and with reference to the above co-operation agreements, a separate co-operation project on the licensing of the Industrial Lepse Project was discussed with the RF Gosatomnadzor in 1997/1998. At a meeting in Stockholm on 25 June 1998, a formal agreement was reached to implement a project "On co-operation in the area of safety regulation and supervision of the (industry) Lepse Project" called the "Regulatory Lepse Project" (RLP). The protocol to the agreement is reproduced as Appendix A.

The European Commission, through its DG-Environment has supported the Nordic project in the form of separate contracts between NRPA and DG-Environment for undertaking specific tasks. Those tasks, although integrated within the RLP, have been reported separately in Sneve et al, [1999], and Sneve et al [2001].

The International Atomic Energy Agency (IAEA) has also supported the project by active participation in workshops.

2. The Regulatory Lepse Project

2.1 Overall objective and work plan

The primary objective of the RLP is to ensure that comprehensive handling of Lepse with the spent nuclear fuel and radioactive waste on board as a source for nuclear and radiation hazard is done in conformity with the current Russian regulations and licensing procedures and in accordance with accepted international praxis. A supplementary objective for the co-operation is to increase the mutual understanding of the work done by the Russian and Western safety authorities.

A successfully used method to support projects is the so-called 2+2 approach. According to this approach, there is Russian and Western co-operation on the industry project and separately, and independently, there is co-operation in a project on licensing/approval of the industry project (illustrated in Figure 1).

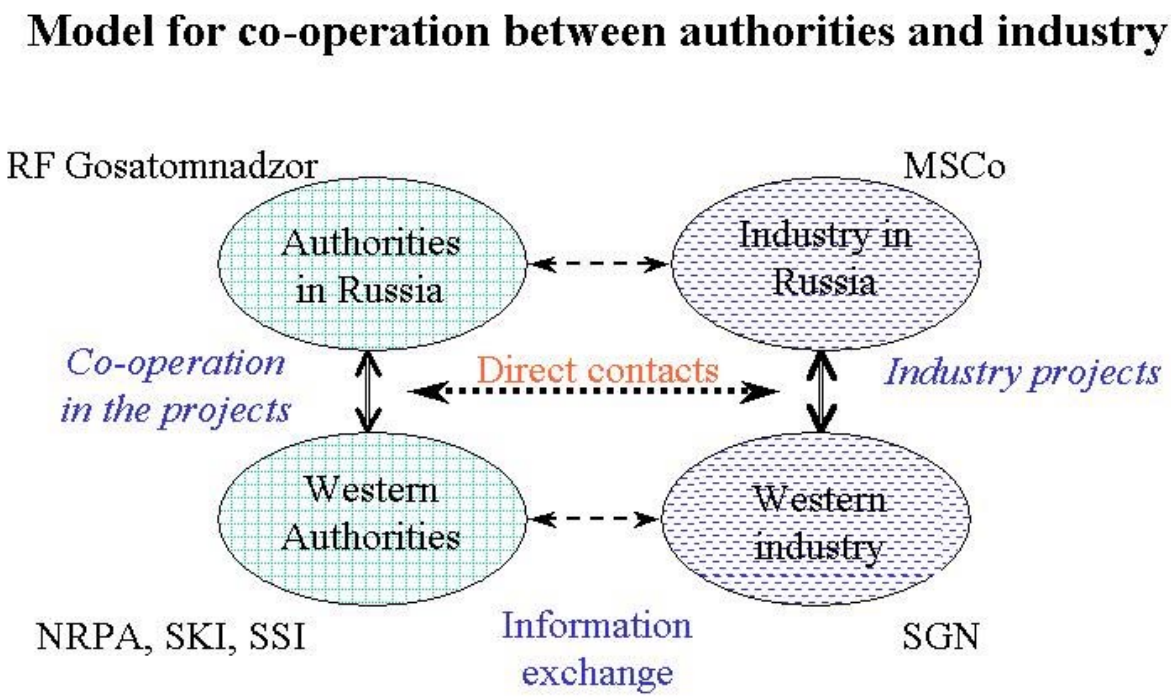

Figure 1. Model for co-operation between RLP and ILP

The main steps in the RLP work plan to be implemented through the 2 + 2 approach were:

- Gathering and analysis of the current legal and regulatory basis for the Lepse project implementation.
- Development of the regulatory guidance documents needed for implementation of the Industry Lepse project.

- Review of the licence application and assessment of the documents on nuclear safety and radiation protection, including peer review with participation of independent experts.
- Preparation, manning and carrying out of inspections with participation of representatives of the authorities from the countries concerned.

2.2 Objective and scope of RLP Phase 1

The full implementation of the RLP can only be done in parallel with the full implementation of the ILP. Due to the lack of a liability agreement between Russia and one of the funding parties, the main activities of the ILP have not yet been launched (as of March 2001), although it has seriously been discussed for a long time and a feasibility study demonstrating a technical solution was completed in 1997 [European Commission, 1997; and SGN Reseau Eurisys, 1997]. Awaiting the initiation of the main ILP, the working group for the RLP agreed on the implementation of a preparatory project RLP Phase 1, which has the following objective:

> ***to support the RF Gosatomnadzor to develop and justify a set of documents to guide those responsible for the implementation of the Industry Lepse Project in the procedure and sequence of activities necessary for obtaining license(s) for the activities included in the Industry Project. The set of documents shall also give guidance in the types and content of the documentation supporting an application to the RF Gosatomnadzor.***

A general principle in management of SNF and radioactive waste is to apply an "integrated solution". This means that all major steps from the generation to the disposal should be known before a decision is taken in order to ensure that an optimal solution can be applied. This principle has been applied in the RLP. It means that the operator should provide the RF Gosatomnadzor with full information on how the spent fuel should be handled and transported after it is removed from Lepse, how it should be stored and eventually how it should be reprocessed or disposed of. However, considering the situation at Lepse, where the spent fuel is in an unacceptable condition as a result of earlier activities, it is justified to focus the scope to the handling on board Lepse and transfer to the dockside. For the subsequent step, the transfer to an interim store, there is a separate industry project ongoing, the Murmansk 80 tonne Cask Project. Within the RLP it should be ensured that the unloading operations would allow all reasonable further management of the SNF.

Within the Phase 1, three Guidance Documents were to be developed, each with a specific objective:

- Requirements on a set and content of documents. Regulatory Guide on Requirements for the composition of a set and content of documents substantiating nuclear and radiation safety ensuring and submitted by the operator and organisations rendering their services to and carrying out work for him with the purpose to get a licence of the RF Gosatomnadzor of Russia in implementation of the Industrial Lepse project. This document is intended to advise the responsible operator, and organisations rendering their services to and carrying out work for him, of the ILP on what documents are to be supplied to the RF Gosatomnadzor in support of an application to unload the Spent Fuel Assemblies (SFA)

on board Lepse and place them in canisters for subsequent transfer into dual purpose - transport and storage – casks.

- Requirements on a quality assurance programme. Safety Guide on Requirements for the quality assurance program of activities for unloading of spent fuel assemblies in implementation of the Industrial Lepse Project. This document covers the RF Gosatomnadzor's requirements on the Quality Assurance Programme to be implemented by the responsible operator of the Industrial Lepse Project.

- Requirements on a safety analysis report. Safety Guide on Requirements for nuclear and radiation safety analysis report for unloading spent fuel assemblies in implementation of the Industrial Lepse project. This document is intended to advise the responsible operator for the Industrial Lepse Project on issues to be addressed in a Safety Analysis Report for the transfer of spent fuel assemblies on board Lepse into canisters for subsequent transfer into dual purpose - transport and storage - casks and the structure of such a document

2.3 Structure and organisation of RLP

A Working Group consisting of Norwegian, Swedish and Russian representatives did co-ordination of all activities within the framework of the Regulatory Lepse Project. The leaders of the Working Group were Ms. M. K. Sneve from NRPA in Norway and Mr. V. Markarov from RF Gosatomnadzor in Russia. The members of the Working Group determined working schedules and plans for implementation of the Regulatory Lepse Project's stages. Organisation of the project is very flat and quite simple which allows for great flexibility.

The Scientific and Engineering Centre on Nuclear and Radiation Safety of the RF Gosatomnadzor (SEC-NRS) provided technical support to the RF Gosatomnadzor, and was responsible for providing documentation describing the background regulatory framework relevant to Lepse as well as draft Guidance Documents. Draft documents were reviewed by western experts from the Norwegian and Swedish regulatory authorities. Review and feedback was also provided by experts from Babcock Rosyth Defence Ltd. and from QuantiSci Ltd., who have specific experience in safety cases for similar handling operations and in safety analysis. In addition, workshops were held to discuss important issues relevant to the development and practical implementation of the guidance being developed. Other relevant Russian authorities and organisations participated in these workshops, as well as the IAEA, and were providing valuable comments and feedback.

The European Commission DG Environment provided funds for the technical support organisations and also hosted one of the workshops. The specific tasks supported by DG Environment were development of terms of reference for the guidance documents [Sneve et al, 1999] and technical support to development of the three guidance documents [Sneve et al, 2001].

3. Summary of activities in Phase 1 of RLP

1. 1998-06-25—26. Meeting in Stockholm with RF Gosatomnadzor, NRPA, SSI/SIUS and SKI/SIP during which the agreement to initiate the RLP was developed and the protocol was signed (Appendix A).

2. 1998-10-22—23. Workshop and working group meeting in Moscow with RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, IAEA, Goscomecology, RF Ministry of Health, RF Ministry of Transport, Minatom and Nuclide during which the distribution of authority and responsibility between different parties was discussed. The work program for 1999 was outlined.
3. 1999-02-9—10. Working group meeting in Drammen with the RF Gosatomnadzor, NRPA, SSI/SIUS and SKI/SIP where the work progress on the terms of references for the guidance documents was discussed as well as plans for other activities like joint inspection on Lepse and monitoring equipment for inspectors.
4. 1999-04-20—22. Working group meeting in Moscow with the RF Gosatomnadzor, NRPA, SSI/SIUS, Babcock Rosyth Defence Ltd.. and QuantiSci Ltd. where the work progress on Terms of References for all documents was discussed as well as plans for joint inspection on Lepse.
5. 1999-06-1—3. Extended meeting in Murmansk with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, Murmansk Shipping Co. (MSCo), Goscomecology, Babcock Rosyth Defence Ltd. and QuantiSci Ltd., where the first draft of the Expanded Terms of Reference for the two documents, Requirements for Quality Assurance Programme (QAP) and Requirements for Safety Analysis Report (SAR) were discussed. The meeting included an inspection on board Lepse.
6. 1999-07-8—9. Working group meeting in Henley with the RF Gosatomnadzor, NRPA, SSI/SIUS, and QuantiSci Ltd. where the development of the document on links between safety assessment and environmental assessment in relevance to Lepse were discussed and agreed.
7. 1999-09-16—17. Working group meeting in Edinburgh with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, Babcock Rosyth Defence Ltd. and QuantiSci Ltd., during which the development of the regulatory guidance documents was discussed. The meeting included the visit on Rosyth Dockyard where British nuclear powered submarine refit work has been carried out.
8. 1999-10-11—12. Working group meeting in Stockholm with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP and QuantiSci Ltd. The purpose of the meeting was to finalise the Expanded Terms of Reference on the guidance documents, and develop the initial report for the DG Environment [Sneve et al, 1999]. At the meeting, details for the next year of work in the RPL were developed
9. 2000-04-26—27. Workshop in Moscow with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, IAEA, Babcock Rosyth Defence Ltd., QuantiSci Ltd., Goscomecology, VNIIPIET, MSCo, RF Ministry of Health and RF Ministry of Transport. The purpose of the workshop was to give a variety of organizations an opportunity to comment on the draft guidance documents prepared by the RF Gosatomnadzor. An additional goal was to promote understanding between the operator and the regulator, and to involve organisations other than the RF Gosatomnadzor in the discussions on the guidance documents. Vital feedback on the draft material was thus provided to the RF Gosatomnadzor and the related technical discussions were fully recorded in the workshop report [NRPA, 2000a].
10. 2000-09-11—12. Working group meeting in Oslo with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, QuantiSci Ltd. and the Norwegian Ministry of Foreign Affairs. There was an update on the progress on development of the three regulatory documents,

and agreement on publication of a report on links between safety assessment and environmental impact assessment [Markarov et al, 2000].

11. 2000-11-24. Workshop in Brussels with the RF Gosatomnadzor, NRPA, SKI/SIP, Babcock Rosyth Defence Ltd., QuantiSci Ltd., MSCo, SGN and several directorates from the European Commission. The main purpose of this workshop was to present the documents developed within Phase 1 of the Regulatory Lepse Project to the European Commission and other organisations involved in both the Industrial and the Regulatory Lepse projects and give the possibilities for comments. The European Commission positively noted the progress achieved during the review workshop. This meeting is fully reported in a report [NRPA, 2000b].
12. 2001-03-29—30. Working group meeting in Moscow with the RF Gosatomnadzor, NRPA, SSI/SIUS, SKI/SIP, QuantiSci Ltd., RF Ministry of Natural Resources, MSCo, RF Ministry of Transport, and the Norwegian Ministry of Foreign Affairs. The status and final form of all three regulatory documents was presented and the final report for Phase 1 of the RLP was discussed. Future activities were also discussed.

Additionally several bilateral meetings between Norwegian and Swedish parties have been held.

4. Results of Phase 1 of RLP

4.1 Introduction

There are two different types of results from the project. One is the increased mutual understanding of the regulatory systems and processes in the Russian Federation and in the Western countries, notably Sweden, Norway and the UK, for licensing nuclear activities. The other is the set of the three Guidance Documents, which are attached to this report.

In contrast to the Swedish and UK legal systems, the Russian system is very prescriptive. In order to avoid misunderstanding of responsibilities efforts have been made to avoid too detailed requirements in the Guidance Documents.

The development of the Guidance Documents during the project has clearly demonstrated that the RF Gosatomnadzor representatives have understood the Swedish and UK way of implementing nuclear safety licensing procedures and have incorporated positive aspects in development of the Lepse Regulatory Guidance Documents consistent with the Russian system. Simultaneously, the western participants have realised that it is not possible, nor suitable to apply the Swedish or UK system directly in the Russian Federation. There has thus been significant improved mutual understanding of both the underlying legal frameworks governing the work by the authorities and principles behind them. This understanding should provide considerable benefit in the implementation of the main activities of the ILP.

4.2 Requirements on a set and content of documents

The unique work to be done when removing the spent nuclear fuel from Lepse has justified special emphasis on identification of the relevant parts of the existing applicable Russian legislation. In the preparation of the Guide, the Russian experts have carefully reviewed the existing documents and great efforts have been made to focus on the parts most relevant for

safety and radiation protection. The ILP will require equipment designed and fabricated outside Russia. This is a new situation and there is limited experience on how to licence the foreign companies manufacturing the equipment as also the equipment itself. However, the Guide addresses all those issues.

The main text in the Guide gives the general provisions and in the six annexes details are given on what documents should be included and what information the documents should contain. The following areas are covered in the six annexes to the Guide:

- Design of spent fuel assembly unloading installations
- Manufacturing of the spent fuel assembly unloading installations
- Construction of the interim store facility
- Operation of the interim store and management of nuclear material
- Management of the spent fuel assembly during removal from the Lepse
- Management of radioactive waste

The information required according to the third and fourth item above should primarily aim at ensuring that the SNF can be properly handled and stored following the removal from the Lepse.

The Chairman of the RF Gosatomnadzor approved the document on 2 April 2001 and it will be in force on 5 June 2001. The full text is included in Appendix B

4.3 Requirements on a quality assurance program

In Western Europe, the system to assure quality in service, engineering and production is made through certification of the responsible organisations performing the service or production. Once certified, regular audits are made to ensure that the quality is maintained. The most frequently used systems are ISO 9001 and ISO 14001. In Western Europe it is now a common requirement that companies have to be certified according to one of the recognised systems in order to win a contract in an open bidding.

In Russia a similar system is under development for a service or production, but not yet in place. It has therefore been considered necessary to give specific requirements on how quality can be assured in the operation to remove the spent nuclear fuel from Lepse.

The objective of this guide is to show the requirements on a quality assurance program (QAP) for unloading spent fuel assemblies during the implementation of the Industrial Lepse project and handling the radioactive waste generated during that operation. The Guide covers the Operator for the Industrial Lepse Project (Murmansk Shipping Company) and also the organisations implementing works and rendering service to the Operator. According to the guide, the following areas must be covered in the quality assurance program:

- Design of equipment to be used for unloading the spent fuel assemblies
- Design of equipment to be used for managing the resulting radioactive waste
- Manufacturing the equipment to be used for unloading the spent fuel assemblies
- Manufacturing the equipment to be used for managing the resulting radioactive waste
- Installation and commissioning of the equipment to be used for unloading the spent fuel assemblies
- Installation and commissioning of the equipment to be used for managing the resulting radioactive waste
- Management of the spent fuel assemblies during unloading

- Management of the resulting radioactive waste

The Guide also points out the quality assurance requirements for the interim storage facilities for spent fuel assemblies and radioactive waste

Two important points, which are elaborated, are the responsibility for the development and implementation of the QAP and auditing to check the implementation of the program

The final version of the Guide has been submitted for approval to the Chairman of the RF Gosatomnadzor. The full text is included as Appendix C.

4.4 Requirements on a Safety Analysis Report

Safety analysis is the single most important tool for assessing nuclear and radiation safety for any nuclear activity. In most countries the Safety Analysis Report, SAR, is together with the Environmental Impact Assessment (EIA) the foundation for the operator's licence application and thus also for the regulatory review and licensing. Consequently it is of great importance that the RF Gosatomnadzor promulgate relevant and clear guidance for the SAR needed for SFA-removal from Lepse.

Typically Western European regulations on SAR are less prescriptive than corresponding Russian guidance documents, as discussed in section 4.1. One challenge for the RLP has been to develop guidance on the SAR for Lepse unloading operations that both benefit from the Western approach and are consistent with the Russian legal framework and tradition.

In the specific situation at hand it must be recognised that Lepse is an existing facility in a far from satisfactory condition. To some extent the situation resembles an intervention rather than a practice. This emphasises the need for the early development of reasonable, clear and well-understood guidance on the SAR.

The Western experts have commented a series of draft guidance documents prepared by the RF Gosatomnadzor, and substantial improvements have been achieved during the process. The final document is still more prescriptive than would be the case in some Western countries but it has a good structure and covers all important aspects of the SAR to be developed by the operator. The document consists of the following ten main sections:

- General provisions
- General description of the Lepse depot ship
- Nuclear and radiation safety
- Safety systems (components)
- Installation for SFA unloading
- Safety analysis of SFA unloading
- Limits and conditions for safe SFA unloading, operational limits of systems (components) of the SFA storage
- Training of personnel, operation and maintenance of systems (components)
- Quality assurance
- Arrangement of activities for SFA unloading from the depot ship storage and emergency preparedness

Within the RLP the Western experts have stressed that early and open discussions between the RF Gosatomnadzor and the operator(s) are essential already when developing and promulgating guidance documents. Consequently the Murmansk Shipping Company has commented the drafts. This was needed in order to avoid unnecessary delays and

misunderstandings at later stages of the implementation of the ILP. Good progress in this respect has been made during RLP. For example, there was broad participation and constructive discussion during the workshop held in Moscow in April 2000 [NRPA, 2000a].

The Chairman of the RF Gosatomnadzor approved the document on 5 April 2001 and it will be in force on 5 June 2001. The full text is included in Appendix D

4.5 Environmental Impact Assessment Report

According to the Russian legislation, the RF Gosatomnadzor is responsible for licensing all activities in the peaceful use of nuclear energy, including management of spent fuel and radioactive waste. However, before major activities can be licensed it is necessary to obtain an overall approval of the activity from the State Committee for Environmental Protection (Goscomecology). The main basis for such an approval is an EIA report. It is outside the scope of the RLP to go into details of EIA. However, the issue is included in a special bilateral project between Norway (NRPA) and Russia (Goscomecology).

In order to consider the common features and differences, it was agreed to make a review of the interaction between Safety Assessment and EIA as regards licensing the unloading of SNF from the Lepse. QuantiSci Ltd. did the study in co-operation with the RF Gosatomnadzor. The report [Markarov et al, 2000] provides a briefing, based on inputs from Russian and Western organisations, of the understanding of the situation and contains several suggestions and comments for further discussions. The report should not be seen as a definite clarification of the situation, but as a report to stimulate further discussions and development of safety assessment and EIA. The key issues identified were to ensure that: a clear understanding is developed of the purpose, scope and endpoints of each assessment; that best and consistent use is made of information which is relevant to both assessments, and that resources are shared where additional information relevant to both assessments is required.

Both the EIA and safety assessment provide major inputs to the management of risks in the short and longer term. Output from the feasibility study made within the ILP has been used in preparation of a paper on risk management for Lepse operations [Sneve, Gordon and Smith, 2001].

5. Conclusions of RLP phase 1

The phase 1 of the RLP has prepared a set of three documents with guidance on the material to be submitted to the RF Gosatomnadzor in order to obtain a licence for the Industrial Lepse Project. In addition, the reports from workshops discussed above held within the RLP provide the basis to justification of the content of the guidance. These reports and the set of guidance documents will be of great help to the organisations responsible for the implementation of the Industrial Lepse project. The work has also established a fruitful and efficient form of co-operation between the RF Gosatomnadzor and Swedish and Norwegian authorities, which will be of great help in the implementation of future regulatory projects.

6. Future activities within RLP

Phase 2 of the RLP, which is the review of the application documents from the operator, will be initiated after the main industry project activities have started. Until then, the guidance documents produced during the Phase 1 of the project will be made available to the operator and other organisations to be involved in the industry project to make them acquainted with the RF Gosatomnadzor's requirements. The operator will have the responsibility for the development of all needed documents. The Swedish and Norwegian parts in the project are prepared to support the RF Gosatomnadzor in that important task, but how it will be done has still to be discussed.

Awaiting the initiation of the Industry Lepse Project, and on the request from the RF Gosatomnadzor, the Norwegian and Swedish parties will initiate a new project. This project will concern preparations for the licensing of the industry project on the design and construction of a special ship to be used for transport of spent fuel and radioactive waste in Northwest Russia.

Acknowledgements

Ms. M.K. Sneve, NRPA, Mr. C. Bergman, SIP, Mr. M. Westerlind, SKI, Mr. V. Markarov and Ms. I. Sokolova, RF Gosatomnadzor have prepared this project report with the support from Mr. L. Malmqvist, SSI. The project could not successfully have been implemented without the great work by SEC NRS team lead by Mr. B Gordon, notably Mr. A. Shulgin, and Mr. A. Stroganov and very valuable comments by Mr. G. Smith QuantiSci Ltd. and Mr. S. Fowell, Babcock Rosyth Defence Ltd. The support from the Waste Safety Section of the IAEA, represented by Mr. E. Warnecke is gratefully acknowledged.

References

- *NRPA (2000a): Development of the regulatory guidance documents within the Lepse Regulatory project.* Report of a workshop in Moscow, April 2000. Norwegian Radiation Protection Authority, Rapport 2000:9, Oslo.
- *NRPA (2000b): Regulatory Lepse Project.* Report of a workshop in Brussels, November 2000. Norwegian Radiation Protection Authority, Oslo.
- *NRPA (1997): Agreement between Norwegian Radiation Protection Authority and Russian Authority Gosatomnadzor of Russia on Technical Co-operation and Exchange of Information Concerning Safe Use of Nuclear Energy*, 20 October 1997. (In Norwegian). Norwegian Radiation Protection Authority. Østerås, Norway, 1999.
- *Swedish Ministry of Environment (1997): Agreement between Sweden and the Russian Federation on Co-operation in the Area of Nuclear Safety and Radiation Protection*. (In Swedish) M97/4530/5.
- *Markarov V G, Smith G M and Stone D (2000): Safety Assessment and Environmental Impact Assessment*: Application to regulation of Nuclear and Radiation Safety, with Special Consideration to Lepse Related Operations. Report prepared within the framework of the cooperation between the Swedish Radiation Protection Institute, the

Norwegian Radiation Protection Authority, and the Federal Nuclear and Radiation Safety Authority of Russia. Swedish Radiation Protection Institute, SSI Report 2000:20, Stockholm.

- *European Commission (1997):* Result of the European Commission Study for Retrieval of Spent Fuel: TACIS Programme. SGN Reseau Eurisys - AEA Technology, May 31st, 1996. Harwell 1996.
- SGN Reseau Eurisys (1997): *LEPSE Ship*: Fuel Removal Transportation and Storage - Phase II Project. "Project Manual" - Detailed Definition and Organisation of the Project. Advisory Committee for the Lepse Project. SGN Reseau Eurisys. St. Quintin Yvelines
- Sneve M K, Gordon B, Fowell S and Smith G (1999)*: Support in Development of Regulatory Procedures for Licensing Lepse Waste Management Operations.* Report prepared for the European Commission by the Norwegian Radiation Protection Authority, Østerås, Norway, 1999.
- Sneve M K, Gordon B and Smith G M (2001): Regulatory Perspectives on Risk Management for Lepse De-Fuelling Operations. In proceedings of VALDOR 2001 Symposium, Swedish Nuclear Power Inspectorate, Stockholm.

Appendices

A. Protocol

B. Guidance on the set of documents

C. Guidance on a quality assurance programme

D. Guidance on a safety analysis report

APPENDIX A

Protocol

APPENDIX B

Guidance on the set of documents

FEDERAL NUCLEAR AND RADIATION SAFETY AUTHORITY OF RUSSIA
(GOSATOMNADZOR OF RUSSIA)

Regulatory Guides

REQUIREMENTS

for the composition of a set and content of documents substantiating nuclear and radiation safety ensuring and submitted by the Operator and organisations carrying out and rendering their services to him with a purpose to get a licence of Gosatomnadzor of Russia in implementation of the Industrial Lepse Project

(UNOFFICIAL TRANSLATION)

Approved by order
of Gosatomnadzor of Russia

of "02" April 001

3.4.2.2. N 20

ENTERS INTO FORCE
on 05 June 2001

RD - 06 – 20-2001

Moscow

CONTENTS

I. General provisions 3

II. Requirements for the composition of a set and content of documents justifying safety. 3

Annex 1. Requirements for the composition of a set and content of documents substantiating nuclear and radiation safety ensuring and submitted by an Applicant to obtain a licence of Gosatomnadzor of Russia for design of the SFA unloading installation 5

Annex 2. Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence of Gosatomnadzor of Russia for manufacture of the SFA unloading installation 6

Annex 3. Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by an Applicant to get a licence of Gosatomnadzor of Russia for construction of the interim storage facility for nuclear materials (casks with SFA) 9

Annex 4. Requirements for the composition of a set and content of documents justifying nuclear and radiation safety and submitted by an Applicant to get licences of Gosatomnadzor of Russia for operation of the interim storage facility for nuclear materials and management of nuclear materials (casks with SFA) 12

Annex 5. Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence for SFA management during their transfer (unloading from the “Lepse” depot ship) 14

Annex 6. Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence for RAW management during their transfer (unloading from the “Lepse” depot ship) 16

I. General provisions

1. The Regulatory Guide “Requirements for the composition of a set and content of documents substantiating nuclear and radiation safety ensuring and submitted by the Operator and organisations carrying out works and rendering their services to him with a purpose to get a licence of Gosatomnadzor of Russia in implementation of the Industrial Lepse Project“ (hereinafter “Requirements) was developed to execute “The Statute on the licensing of activities in the use of nuclear energy” (Article 11 g) approved by Decree N 865 of the Government of the Russian Federation dated 14 July 1997.
2. These “Requirements” define the composition of a set and content of documents justifying nuclear and radiation safety ensuring (hereinafter “ documents justifying safety”) and cover types of activities needed for unloading of SFA from the Lepse stores and other activities in implementation of the Industrial Lepse Project.
3. An Organisation – juridical person (hereinafter the Applicant) submitting to Gosatomnadzor of Russia an application to get a licence for the following activities must comply with these Requirements:

3.1. Design of the SFA unloading installation.
3.2. Manufacture of the SFA unloading installation.
3.3. Construction of the interim storage facility for nuclear materials (casks with SFA).
3.4. Operation of the interim storage facility for nuclear materials and management of nuclear materials (casks with SFA).
3.5. Management of SFA during their transfer (removal from the Lepse Depot Ship).
3.6. Management of RAW during their transfer (removal from the Lepse Depot Ship).

II. Requirements for the composition of a set and content of documents justifying safety.

4. Requirements for the composition of a set and content of documents justifying safety and submitted by the Applicant to obtain licences of Gosatomnadzor of Russia for the activities listed below are given in the Annexes 1-6:

4.1. Design of the SFA unloading installation (Annex 1).
4.2. Manufacture of the SFA unloading installation (Annex 2).
4.3. Construction of the interim storage facility for nuclear materials (casks with SFA) (Annex 3).
4.4. Operation of the interim storage facility for nuclear materials and management of nuclear materials (casks with SFA) (Annex 4).
4.5. Management of SFA during their transfer (removal from the Lepse Depot Ship) (Annex 5).
4.6. Management of RAW during their transfer (removal from the Lepse Depot Ship) (Annex 6).

5. The previously developed Regulatory Guides of Gosatomnadzor of Russia set up requirements for the composition of a set and content of documents justifying safety of all activities listed in items 5.1 – 5.3:

5.1. For the operation of the RAW storage facility and RAW management during their storage, treatment and transfer – “Requirements for the composition of a set and content of documents justifying radiation safety ensuring of the licensed activity in the use of nuclear energy in the national economy” (RD-07-08-99) (in connection with the operation of the RAW storage facility) and “ Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring of the licensed activities at ship building and repair plants” (RD-06-17-97).

5.2. For the design, engineering and manufacture of equipment composing the SFA unloading installation – “Requirements for the composition of a set of documents justifying ability to assure quality and safety in engineering and manufacture of equipment for nuclear installations, radiation sources, storage facilities of nuclear materials and radioactive substances and storage facilities for RAW” (RD-03-41-97).

5.3. For the design, engineering and manufacture of casks for the interim storage and transport of SFA – “Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring of the licensed activities of fuel cycle facilities and organisations implementing works and rendering services to them” (RD-05-15-97).

6. The content of documents justifying safety should be in compliance with the requirements of Federal Rules and Regulations (Norms and Rules) being in effect at the time of submission an Application to get a licence of Gosatomnadzor of Russia and these Requirements.

ANNEX 1

Requirements for the composition of a set and content of documents substantiating nuclear and radiation safety ensuring and submitted by an Applicant to obtain a licence of Gosatomnadzor of Russia for design of the SFA unloading installation

The following documents should be included in this set of documents:

1. Technical substantiation of the selection of the SFA unloading mode and the SFA unloading installation containing description and evaluation of different options for the SFA unloading installation.
2. Reference information on activities implemented by the organisation before and describing its experience in designing of installations similar to the SFA unloading installation.
3. Quality Assurance Programme for the design and engineering activities. In particular, the following information has to be presented in these document:

    - On the arranging of development, approval, putting into effect and emending of the design and engineering documentation, on software used for design and engineering, on establishment of the control service to check compliance with the current standards for design;
    - On the system of interactions with organisations using the developed design and engineering documentation for manufacturing of the SFA unloading installation and for its assembling, as well as information about the system of accounting for and analysing of discrepancies of this documentation and measures taken to eliminate them.
4. Reference information on availability of the test bench base and experimental production facilities within an organisation.
5. Reference information on staffing of the Applicant with the skilled personnel with indication of their education and experience or special training they passed. Information on the testing of knowledge of requirements set up in Federal Rules and Regulations (norms and Rules) in the use of nuclear energy among the personnel involved in designing and engineering of the SFA unloading installation is also to be presented.
6. Reference information containing a list of the regulatory (normative) and technical documentation on safety, which requirements are to be met by the developed design of the SFA unloading installation.

ANNEX 2

Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence of Gosatomnadzor of Russia for manufacture (construction) of the SFA unloading installation

The following documents are to be included into this set of documents:

1. SAR (Report on safety justification of the SFA unloading installation), which includes in particular the following data:

1.1. Preliminary overview of issues concerned with safety.

1.2. Estimation of a probability of accidents and their radiological impact on the workers (personnel), population and the environment. Compliance of status of radiation safety with International and Russian Federal rules and regulations (norms and Rules) in the use of nuclear energy. Data on estimated absorbed doses, dose equivalents, effective dose equivalents anticipated for the internal exposure, annual effective dose equivalents, collective effective doses and doses which may be prevented are to be presented.

1.3. Ensuring of radiological protection:

- A list of initiating events for each of the main operations and the identified critical safety issues;
- Analysis of causes of the possible transport of radioactive substances in case of:
  - an accident during SFA handling, caused by failures of casks or extreme weather conditions;
  - failure of the equipment;
  - failure of the protective barrier;
- Description of protective means used to preserve protective barriers in case of accidents during SFA handling;
- Methods and techniques used for management of the exposure doses and other parameters of radiation protection during the whole working shift and in the process of implementation of all operations;
- Estimation of the collective and individual effective doses for the planned normal operation. Measures foreseen in case of the planned or emergency dose exceeding;
- Effective collective dose;
- Working places where the highest radiation impact on the workers during the whole working shift is possible;
- Arrangement of the radiation monitoring and technical means necessary for its implementation;
- Arrangement of the use of protective radiation shields to decrease an effect of gamma-radiation;
- Treatment of materials and items contaminated by and/or containing radioactive nuclides, as well as RAW treatment.

1.4. Criticality:

- Preliminary overview of the critical safety issues;
- A list of the parameters monitored to ensure subcriticality of SFA inside the store;

- Identification of a potential possibility of changes of these parameters caused by SFA removal operations;
- Identification of the monitored parameters;
- Conditions of SFA storage;
- Parameters providing for the criticality control;
- A value of neutron multiplication factor (K_{eff});
- Identification of safety issues concerned with criticality;
- Ensuring of safety concerned with criticality (maintaining of the existing monitored parameters with a purpose to plan work or predict emergencies).

1.5. Accidents in the load-lifting operations.
Estimation of probability of such accidents.
Changing of safety parameters caused by accidents during the load-lifting operations.

1.6. Estimation of the fire hazard level. Description of the fire protection measures.

1.7. Estimation of impact of extreme meteorological conditions on safety.

1.8. Estimation of initiating events concerned with the use of electricity.
Consequences that may be caused by the termination of power supply.

1.9. Information on manufacture of the equipment and completing articles for the SFA unloading installation (should be in compliance with the requirements of RD-03-41-07).

2. Statement of the expert review of the design documentation for the SFA unloading installation.
3. Design and engineering as well as operational documentation, documentation for manufacture of the SFA unloading installation (specific documents are submitted to Gosatomnadzor of Russia upon its request).
4. Reference information on the activities implemented by the organisation before, which demonstrates its experience in manufacturing of installations similar to the SFA unloading installation.
5. Quality Assurance Program for implementation of SFA unloading operations where in particular the following information is included to:

    - On availability of conditions for production within an organisation which ensure manufacture of the SFA unloading installation in a full compliance with the requirements of the design and engineering documentation, Federal Rules and Regulations in the use of nuclear energy including:
        - Procedure for manufacture of the SFA unloading installation accepted within the organisation;
        - Procedure for handling of the design and engineering documentation;
        - Procedure for development of the working documentation for manufacture of the SFA unloading installation; providing all working places with this information;
    - On equipping of the organisation with testing means, tools and accessories, laboratory devices and measuring instrumentation;
    - On the procedure for the input control, store and use of materials and completing articles for production;
    - On a nomenclature (list) of the accounting and reporting documentation currently used within in the organisation, including documentation on control over production during each operation and procedure for formatting of this documentation;

- On a metrology support to production;
- On the procedure of accounting for claims relating to quality of the SFA unloading installation and procedure of taking measures to manage defects revealed during tests and operation.

6. Reference information on staffing of the organisation with the skilled personnel describing their education and experience or special training they passed. Information on examination of knowledge of the requirements of the Federal Rules and Regulations in the use of nuclear energy among the personnel involved in manufacturing of the SFA unloading installation.
7. Testing programs of the SFA unloading installation (specific documents are submitted to Gosatomnadzor of Russia upon its request).
8. Copies of certificates for equipment completing the SFA unloading installation and being a subject of the obligatory certification according to the legislation of the Russian Federation.
9. Data on the estimations of a possibility of RAW generation during operations for casings removal from the tanks of the storage facility and SFA from the caissons of the “Lepse” depot ship.
10. Documentation on decommissioning of the SFA unloading installation.

ANNEX 3

Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by an Applicant to get a licence of Gosatomnadzor of Russia for construction of the interim storage facility for nuclear materials (casks with SFA)

The following documents are to be included in this set of documents:

1. Copy of the decision of the State Authorities on the construction of the storage facility (hereinafter storage facility means facility for the interim storage of nuclear materials (casks with SFA)).
2. Feasibility Study.
3. SAR (Safety Justification Report) for the storage facility considering SFA features and modes of storage (inside TUK-18, metal-concrete casks, etc.) including:
    - General information on the storage facility;
    - Conditions for its construction;
    - Description of the region and site for construction of the storage facility, substantiation of the site selection on the basis of feasibility study of the design; data on agricultural and recreation territories situated within the surveillance area;
    - Data on geology, seismic, hydrology and meteorology parameters of the site for construction of the storage facility;
    - Data on water reservoirs located within the surveillance area and used for fishing, as a source of drinking water and for industry needs;
    - Information on the endpoints (borders) of the buffer area and surveillance area;
    - Information on the nearest inhabited localities and industrial facilities;
    - Information on the roads, railways and water-ways located in the vicinity of the construction site of the storage;
    - Location layout;
    - Main technical parameters;
    - Safety analysis of the storage facility;
    - Nuclear safety ensuring;
    - Radiation safety ensuring;
    - Fire protection ensuring;
    - Ensuring of the storage facility protection against natural and artificial impacts;
    - Results of the quantitative safety analysis, including information on consideration of effects of natural and artificial factors on safety of the storage facility in accordance with the requirements of PNAE G-05-035-94 “Consideration of the effluence of natural and artificial external events on nuclear and radiation hazardous facilities ()”;
    - A list and analysis of initiating events for radiation accidents;
    - An estimation of a probability of the release and transport of the radioactive substances;
    - A list of measures to prevent accidents;
    - Fire protection measures.

4. Detailed design for the construction of the storage facility. General explanatory note and feasibility study part. Arrangement of the construction activities. Design

documentation for safety important systems (are to be submitted upon the request of Gosatomnadzor of Russia).

5. Environmental Impact Assessment (EIA) including discharges and releases of radioactive substances.
6. A plan of measures to protect workers and population in case of an accident.
7. Decision (conclusion) of the expert commission for the state ecological review of the detailed design for the construction of the storage facility. Copy of the order on approval of the conclusion of the state ecological review.
8. Brief description of the processes.
9. Quality Assurance Program for construction of the storage facility where in particular the following information should be presented:
    - On availability of the means and conditions for production within an organisation which ensure construction of the storage facility in a full compliance with the requirements of the design and engineering documentation, Federal Rules and Regulations (Norms and Rules) in the use of nuclear energy;
    - On establishment of the control service to check compliance with the current standards (norms);
    - On the equipping of the organisation with testing means, tools and accessories, laboratory devices and measuring instrumentation;
    - On a nomenclature (list) of the accounting and reporting documentation currently used within the organisation, including documentation on control over production during each operation and procedure for formatting of this documentation;
    - On a metrology support to production;
    - On the procedure of accounting for claims relating to quality of the SFA unloading installation and procedure of taking measures to manage defects revealed during tests.
10. Reference information on the staffing of the organisation with skilled personnel describing their education and experience or special training they passed. Information on examination among the personnel involved in construction of the storage facility with a purpose to check knowledge of requirements of the Federal Rules and Regulations (Norms and Rules) in the use of nuclear energy.
11. Copies of certificates for equipment intended to be used at the storage facility and being a subject of the obligatory certification according to the legislation of the Russian Federation.

ANNEX 4

Requirements for the composition of a set and content of documents justifying nuclear and radiation safety and submitted by an Applicant to get licences of Gosatomnadzor of Russia for operation of the interim storage facility of nuclear materials and management of nuclear materials (casks with SFA)

The following documents are to be included in this set of documents:

1. SAR (Report on Safety Justification of the Operation of the storage facility). Particularly the following data should be included in this SAR:
    - Conditions for nuclear and radiation safety ensuring;
    - A list of premises where casks with SFA may be stored;
    - Characterisation of the process safety within the declared activity with indication of availability of conclusions (decisions) on safety and names of organisations issued the corresponding conclusions;
    - Description of the process of storage and transfer of casks with SFA;
    - Rules setting up periodicity of the cask integrity examinations

2. A list and description of equipment for SFA loading including casks with indication of the number of equipment position, number of drawing, type of equipment and safe (authorised) parameters.
3. Description and estimation of a status of nuclear and radiation safety in implementation of individual works (nuclear material management).
4. A list of the considered initiating events, violations, failures which can lead to the excess of the safe (authorised) parameters, results of the analysis of their consequences for the personnel and population. Emergency response plan for mitigation of accident consequences and protection of the environment.
5. Copy of the Report on acceptance of the storage facility for operation, including the results of the acceptance tests.
6. Reference information on compliance with the licence conditions for construction of the storage facility.
7. Quality Assurance Program for operation of the storage facility where in particular the following information should be presented:

    - On availability of the means and conditions within the organisation which ensure operation of the storage facility and handling of nuclear materials in a full compliance with the requirements of the operating documentation, Federal Rules and Regulations (Norms and Rules) in the use of nuclear energy;
    - On establishment of the nuclear and radiation safety service (unit);
    - On equipping of the organisation with control (monitoring) means for nuclear safety, radiation and fire protection;
    - On a nomenclature (list) of the accounting and reporting documentation used within the organisation, including documentation on the control over the process of storage and transfer of casks with SFA and procedure for formatting of this documentation.
8. Reference information on the staffing of the organisation with skilled personnel describing their education and experience or special training they passed. Information on examination of knowledge of requirements of the Federal Rules

and Regulations in the use of nuclear energy among the personnel involved in operation of the storage facility and handling of nuclear materials.

9. Design and operational documentation including design documents for safety important systems (are submitted upon a request of Gosatomnadzor of Russia).
10. Reference information on ensuring of physical protection of the storage facility including information on implementation of the requirements set up in the Rules for Physical Protection of Nuclear Materials, Nuclear Installations and Storage Facilities. The copies of permissions given to officials for the authorisation to carry our activities in the physical protection area and data on certification of technical means used for creation of the physical protection system are to be attached to this Reference information.
11. Analysis of compliance of the conditions for the declared activity implementation with the requirements of Nuclear and Radiation Safety Regulations currently in force with indication of the existing deviations and measures to compensate them.
12. Arrangement for registration of the individual doses of the personnel, analysis of radiation doses received by the individual groups of workers.
13. Statement on the readiness of the storage facility to receive casks with SFA where it is necessary to indicate readiness of the corresponding services (units) and equipment for receiving of casks with SFA and providing for their interim storage.

ANNEX 5

Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence for SFA management during their transfer (unloading from the “Lepse” depot ship).

The following documents are to be included in a set of documents:

1. SAR (Report on Safety Justification of the management of SFA during their unloading from the “Lepse” depot ship, including conclusion of the Lepse Designer on stability and unsinkability of the ship during implementation of the SFA unloading operations. (The Safety Guide “Requirements for the Report on justification of nuclear and radiation safety ensuring during SFA unloading in implementation of the Industrial Lepse Project” defines requirements for the content of this document).
2. Environmental Impact Assessment.
3. Quality Assurance Program for SFA management during their unloading from Lepse (The special document of Gosatomnadzor of Russia, namely “Requirements for Quality Assurance Program for implementation of activities during unloading of SFA in implementation of the Industrial Lepse Project” defines requirements for Quality Assurance Program).
4. Preliminary design of the SFA unloading installation. Technology and equipment for SFA unloading from the “Lepse” depot ship, including:
    - Transfer-process diagram of unloading;
    - Process rules for SFA unloading from “Lepse and placing into casks;
    - Technical specifications and operational manuals for operation of the SFA unloading installation (are submitted upon the request of Gosatomnadzor of Russia).
5. Acceptance statement for the SFA unloading installation.
6. A list of the considered events, incidents, failures which may lead to the excess of the safe (authorised) parameters, results of analysis of their consequences with regard to their impact on the personnel and population. Emergency plan for mitigation of accident consequences and protection of the environment.
7. Copies of the documents of the Russian Marine Register of Navigation confirming an operable technical state of the ship itself and her technical means ensuring safety of the SFA unloading and the ship herself.
8. A list of measures for preparation of the SFA unloading installation for its decommissioning.
9. Reference information on availability and types of the casks for interim storage and transport of SFA with indication of the certificate numbers.
10. Reference information confirming availability of nuclear and radiation safety control system and nuclear materials accounting for and control system, including description of the structure and composition of the services (units) of nuclear and radiation safety providing for implementation of SAF unloading operations.
11. Information on availability within the Applicant of the system for nuclear materials accounting for, control and physical protection.
12. Arrangements for the registration of the individual doses of the personnel, analysis of radiation doses received by the individual groups of workers.

ANNEX 6

Requirements for the composition of a set and content of documents justifying nuclear and radiation safety ensuring and submitted by the Applicant to obtain a licence for RAW management during their transfer (removal from the “Lepse” depot ship).

The following documents are to be included in a set of documents:

1. SAR (Report on Radiation Safety Justification in the management of RAW during their unloading from the “Lepse” depot ship. (The Safety Guide “Requirements for the Report on justification of nuclear and radiation safety ensuring during SFA unloading in implementation of the Industrial Lepse Project” defines requirements for the content of this document).
2. Assessment of Impact of the RAW management operations during RAW transfer on the Environment.
3. Quality Assurance Program for RAW management during their unloading from Lepse (The special document of Gosatomnadzor of Russia, namely “Requirements for Quality Assurance Program for implementation of activities during unloading of SFA in implementation of the Industrial Lepse Project” defines requirements for Quality Assurance Program).
4. Copies of the documents of the Russian Marine Register of Navigation confirming an operable technical state of the depot ship itself and her technical means ensuring safety of RAW management and the ship herself.
5. Reference information confirming availability of radiation safety control system and RAW management system, including description of the structure and composition of the services (units) of radiation safety providing for implementation of RAW management operations.
6. Analysis of emergencies, violations and failures which may lead to the excess of the safe (authorised) parameters, results of analysis of their consequences with regard to their impact on the personnel and population. Emergency plan for protection of the personnel, population and the environment.
7. Arrangements for the registration of the individual doses of the personnel, analysis of radiation doses received by the individual groups of workers.

APPENDIX C

Guidance on a quality assurance programme

FEDERAL NUCLEAR AND RADIATION SAFETY AUTHORITY OF RUSSIA (GOSATOMNADZOR OF RUSSIA)

---

1 SAFETY GUIDES

Approved by the order
of Gosatomnadzor of Russia
Dated " " 2001
№

REQUIREMENTS FOR QUALITY ASSURANCE PROGRAM FOR CARRYING OUT OF ACTIVITIES FOR UNLOADING OF SPENT FUEL ASSEMBLIES IN IMPLEMENTATION OF THE INDUSTRIAL LEPSE PROJECT

RB-017-01

(UNOFFICIAL TRANSLATION)

COMES INTO FORCE
On 2001

MOSCOW 2001

UDK 629.123.5:621.039

REQUIREMENTS FOR QUALITY ASSURANCE PROGRAM FOR CARRYING OUT OF ACTIVITIES FOR UNLOADING OF SPENT FUEL ASSEMBLIES IN IMPLEMENTATION OF THE INDUSTRIAL LEPSE PROJECT RB-017-01

Gosatomnadzor of Russia

Moscow, 2001

This Safety Guides establishes requirements for Quality Assurance Program for implementation of spent fuel assemblies unloading activities including unloading of the damages assemblies placed inside cases with the use of specially manufactured process equipment. Quality Assurance Program for carrying out of activities in implementation of the Industrial Lepse Project developed in accordance with the stated requirements will be included into a set of documents justifying nuclear and radiation safety ensuring in implementation of operations for unloading of spent fuel from the tanks of the Lepse store.

This Guide was prepared in developing of the Federal Rules and Regulations (Norms and Rules) “Quality Assurance Program for NPP” (NP-011-99), “Requirements for Quality Assurance Program for Operation of the Nuclear Fleet” (RD-31.20.24-94) and “Safety Rules for storage and transfer of nuclear fuel at nuclear power engineering facilities” (PNAE G-14-029-91). Specific character of implementation of activities in the store of the third safety class was taken into consideration.

Approaches for safety ensuring in unloading of spent fuel verified by the long term practice and specified in the above mentioned regulations were used for development of this regulatory (normative) document.

This regulatory document is issued for the first time.

E.V.Laukhin (Gosatomnadzor of Russia), A.A. Stroganov, R.B. Sharafutdinov and A.Ya. Sulgin (SEC NRS) participated in development of this Safety Guide.

Suggestions and comments provided by the Departments of Gosatomnadzor’s HQ, North-European Regional Office of Gosatomnadzor of Russia, the Operator (MSCo), RF Ministry of Transport, as well as experts from IAEA, the UK, NRPA, SIP and SKI were considered in developing of this document.

TABLE OF CONTENTS

List of Abbreviations.....44
TERMS AND DEFINITIONS.....45
1. PURPOSE AND AREA OF APPLICABILITY.....47
2. GENERAL PROVISIONS.....47
3. REQUIREMENTS FOR THE COMPOSITION OF QUALITY ASSURANCE PROGRAMS FOR THE PROJECT IMPLEMENTATION.....48
4. FUNCTIONS OF THE OPERATOR AND ORGANIZATIONS CARRYING OUT WORKS AND RENDERING SERVICES TO THE OPERATOR IN DEVELOPING OF THE QUALITY ASSURANCE PROGRAM AND THEIR RESPONSIBILITIES FOR DEVELOPMENT OF QUALITY ASSURANCE PROGRAMS.....49
5. REQUIREMENTS FOR THE CONTENT OF QUALITY ASSURANCE PROGRAM50
6. REQUIREMENTS FOR IMPLEMENTATION OF QUALITY ASSURANCE PROGRAM FOR THE PROJECT IMPLEMENTATION.....51
7. REQUIREMENTS FOR CERTIFICATION OF THE USED EQUIPMENT, ARTICLES AND TECHNOLOGIES.....51
ANNEX 1 53
ANNEX 2 67

List of Abbreviations

QAP	- Quality Assurance Program for implementation of the Project for unloading of SFA from the Lepse store (hereinafter Project).
QAP(G)	- General Quality Assurance Program in the Project implementation
QAP(D)I	- Quality Assurance Program for development (Design) of the complex (installation) for SFA unloading from the Lepse store
QAP(D)E	- Quality Assurance Program for development of equipment composing a complex of equipment intended to be used for SFA unloading from the Lepse store and important to safety in the Project implementation
QAP(M)E	- Quality Assurance Program for manufacturing of the equipment intended to be used for SFA unloading from the Lepse store and important to safety in the Project implementation
QAP(E)I	- Quality Assurance Program for erection of the complex (installation) – mounting and adjustment of equipment composing the installation, intended to be used for SFA unloading from the Lepse store and important to safety in the Project implementation
QAP(C)I	- Quality Assurance Program for commissioning of the complex (installation) for SFA unloading from the Lepse store
QAP(O)I	- Quality Assurance Program for activities of the SFA unloading from the Lepse DS including: removal of casings with SFA from the Lepse store, their drying and putting into cases, sealing of the cases and their putting into transport casks, transfer of these casks to the facilities specified by the Project and used for the interim storage of casks with SFA unloaded from the Lepse DS expecting their following transport to out of the boundaries of the Operator site
QSA(Dc)I	- Quality Assurance Program for decontamination and dismantling of equipment used for SFA unloading from the Lepse store after completion of the Project and for management of the generated secondary Radioactive Waste
DS	- Depot Ship (floating engineering base)
SFA	- Spent Fuel Assemblies
SNF	- Spent Nuclear Fuel
O	- the Operator

TERMS AND DEFINITIONS

The following terms and definitions are used in this document:
Audit – systematic and independent analysis carried out with a purpose to evaluate effectiveness of the Quality Assurance Program for the Project Implementation
Corrective measures – measures for elimination of the revealed disparities with a purpose to prevent their recurrence (according to NP-011-99)
Disparity – failure to meet one or a number of the established requirements (according to NP-011-99)
Effectiveness of QAP – parameter of QAP specifying an extent of reaching the QAP goals and served as an indicator that QAP goals established by the Management of the Operator or organisation implementing works and rendering services to him have been reached.
General Quality Assurance Program for SFA unloading from the Lepse DS - Quality Assurance Program for implementation of the Project by the Operator (MSCo), organisational and co-ordinating activities of the Operator and organisations implementing works and rendering service to the Operator (RTP “Atomflot”, SGN, etc.)
Procedure – a document (for example, standards of quality system of the organisation, production manual, technique or special program) regulating ways and order of actions providing for implementation of safety important activities, as well as order and methods for control of the results of these activities
Quality - a set of properties and characteristics of activities (services) or equipment in SFA unloading from the Lepse DS
Quality Assurance in unloading of SFA from the Lepse DS (hereinafter - **quality assurance**) - planned and systematically implemented activities aimed at ensuring that all works for SFA unloading from Lepse affecting nuclear and radiation safety are carried out in the specified way and the results of these works meet the established requirements at all stages of the Project implementation
Quality Assurance Policy – Main actions and goals of the Operator implementing the Project or the organisation implementing works and rendering services to the Operator in the area of quality to ensure safety. The Management of the Operator or Management of the organisation implementing works and rendering services to the Operator establishes these actions and goals
Quality Assurance Program for implementation of the Project for SFA unloading from the Lepse DS – a document (a set of documents) specifying a set of administrative, technical and other measures for QA aimed at implementation of the established criteria and principles for safety ensuring in the Project implementation
Quality control - an element of activity for quality assurance which allows to estimate if the work (service) and/or equipment is in compliance with the established requirements
Quality management – methods and types of activities of the efficient nature implemented with a purpose to meet quality requirements
Quality requirements – the established quantitative and qualitative values of properties and characteristics of works (services) and/or equipment

Revision of Quality Assurance Program - verification of QAP with a purpose to confirm its compliance with the established requirements or to make possible improvements

Service - implementation of works at individual stages of the overall Project

Specific Quality Assurance Program in unloading of SFA from the Lepse DS (hereinafter - **specific quality assurance program**) - QAP of activities (services) of the Operator or organisation implementing works and rendering services to the Operator at the specific stage of the Project.

1. PURPOSE AND AREA OF APPLICABILITY

1.1. Safety Guide “Requirements for Quality Assurance Program for Carrying out of Activities for Unloading of Spent Fuel Assemblies in Implementation of the Industrial Lepse Project” (hereinafter Guide) sets up the objective of the Quality Assurance Program for the Project implementation. It also establishes requirements for the composition, contents and implementation of the Quality Assurance Program in a course of the Project.
1.2. The Guide is applied for SFA unloading from the Lepse DS and implementation of similar activities on other DSs.
1.3. This Guide was developed for:
the Operator implementing the Project (Murmansk Shipping Company;
Organizations implementing works and rendering services to the Operator (RTP “Atomflot”, SGN, etc.).

2. GENERAL PROVISIONS

2.1. The objective of QAP in implementation of the Project is the regulating of activities on quality assurance aimed at implementation of the main criteria and principles for safety ensuring in the course of the Project and carried out by the Operator and organizations fulfilling works and rendering services to him.
2.2. Layout and reliability of systems (components) important to safety in the Project implementation, documentation and different types of activities affecting safety in the Project implementation are subjects of activity for quality assurance of the Project implementation.
2.3. Activities for quality assurance of the Project implementation carried out in accordance with QAP should provide for:
Compliance of all works and services carried out in implementation of the Project as well as specially manufactured equipment and equipment of serial production important to safety used for this Project with regulatory requirements;
Compliance (upon completion of each stage of the Project) of all final results of the mentioned works with requirements established for that exact stage by the Project Design Documentation (including the specified final state the Lepse DS should be put in after completion of the Project);
Timely revealing of quality disparities deviations from the requirements for quality of works (services) or equipment that can result in unacceptable quality of works (services) or equipment from the point of view of nuclear and radiation safety requirements;
Timely application of the corrective measures developed beforehand that allow elimination of the revealed disparities and preventing of their recurrence;
Effective quality control of implementation of all works and equipment used at any stage of the Project implementation;
A possibility to fix a fact of approaching of responsibility for the inappropriate implementation of QAP at any stage of Project implementation and clearly define a responsible Party (The Operator or one of the organizations carrying out works and rendering services to him) and responsible structural unit.
2.4. The Operator implementing the Project develops the General Quality Assurance Program for the Project implementation – QAP(G) on the basis of the requirements set up in this document.
This QAP (G) should:

- Comply with requirements of the Federal Rules and Regulations in the use of nuclear energy;
- Define policy of the Operator in the quality assurance area;
- Set up requirements for specific quality assurance programs.

2.5. Organizations carrying out works and rendering services to the Operator (contractors) develop their own specific quality assurance programs for implementation of activities at specific stages of the Project, namely QAP (D)I, QAP (D)E, QAP (M)E, QAP (E)I, QAP (C)I, QAP (O)I, QAP (Dc)I on the basis of requirements of this document and requirements of QAP (G). These QAPs should:

- Comply with requirements of the Federal Rules and Regulations in the use of nuclear energy;
- Comply with Policy of the Operator in the quality assurance area and with requirements for these specific QAPs set up by the QAP (G) of the Operator;
- Establish requirements for specific QAPs of the sub-contractors carrying out works and rendering services to the contractors through the contractual relations (if the involvement of such organizations is specified by the administrative scheme of the Project implementation).

2.6. All sub-contractors participating in the Project implementation and carrying out works and rendering services to other sub-contractors develop own specific QAPs for specific works at specific stages of the Project implementation. The requirements of this document and requirements of the corresponding QAPs of the mentioned sub-contractors implemented through the contractual relations serve as a basis for development of these QAPs. All requirements for specific QAPs set up by the QAP (G) of the Operator are to be met independently of the number of participants in the chain of the contracts between the Operator and sub-contractors.

2.7. While carrying out design, erection (mounting), commissioning, operation and decommissioning of the installation for SFA unloading from the Lepse DS as well as design and manufacture of equipment for this installation, the Operator and organizations carrying out works and rendering services to him should ensure implementation and improvement of the developed QAPs used in the Project or at its specific stages.

2.8. This Safety Guide has been developed in compliance with the regulation in the nuclear power engineering “Requirements for quality assurance program for NPP” (NP-011-99) taking into consideration specific character of the working technology and design of the Lepse DS and recommendations of the IAEA Guides.

3. REQUIREMENTS FOR THE COMPOSITION OF QUALITY ASSURANCE PROGRAMS FOR THE PROJECT IMPLEMENTATION

3.1. General Quality Assurance Program QAP (G) and specific QAPs for the following activities are developed for the Project implementation:

- Development (design) of the complex (installation) for SFA unloading from the Lepse DS – QAP (D)I;
- Development of equipment, articles and systems important to safety of the Project implementation – QAP (D)E;
- Manufacture of equipment, articles and systems important to safety of the Project implementation – QAP (M)E;
- Erection of the complex (installation) for the SFA unloading from the Lepse DS – QAP(E)I;

- Commissioning of the complex (installation) for the SFA unloading from the Lepse DS – QAP(C)I;
- Operation of the complex (installation) for the SFA unloading from the Lepse DS – QAP(O)I (SFA management during their unloading including removal of casings with SFA from the Lepse tanks, their drying and putting into cases, sealing of the cases and their putting into transport casks, transfer of these casks to the facilities specified by the Project and used for the interim storage of casks with SFA unloaded from the Lepse DS expecting their following transport to out of the boundaries of the Operator site);
- Decommissioning of the complex (installation) for the SFA unloading from the Lepse DS – QAP(Dc)I.

3.2. If organizations carrying out works and rendering services to the Operator in the Project implementation (contractors) on the basis of requirements of this document, requirements of QAP(G) and requirements of the specific QAPs – QAP(D)I, QAP(D)E, QAP(M)E, QAP(E)I, QAP(C)I, QAP(O)I and QAP(Dc)I engage sub-contractors for these works and/or services, they have to define additional requirements for the composition of QAPs thus that requirements of item 2.6 are met.

3.3. If organizations carrying out works and rendering services to the Operator in the Project implementation (contractors) on the basis of requirements of this document, requirements of QAP(G) and requirements of the specific QAPs – QAP(D)I, QAP(D)E, QAP(M)E, QAP(E)I, QAP(C)I, QAP(O)I and QAP(Dc)I engage sub-contractors for these works and/or services according to such terms and conditions that ensure compliance with requirements of item 2.6, by this they define additional requirements for the composition of QAPs.

3.4. Organizations carrying out works and rendering services to the Operator in the Project implementation (contractors) on the basis of requirements of this document, requirements of QAP(G) and requirements of the specific QAPs – QAP(D)I, QAP(D)E, QAP(M)E, QAP(E)I, QAP(C)I, QAP(O)I and QAP(Dc)I and engaging sub-contractors for these works and/or services according to such terms and conditions that ensure compliance with requirements of item 2.6 and setting up requirements for specific QAPs of the sub-contractor according to item 2.5 define by this additional requirements for the composition of QAPs.

4. FUNCTIONS OF THE OPERATOR AND ORGANIZATIONS CARRYING OUT WORKS AND RENDERING SERVICES TO THE OPERATOR IN DEVELOPING OF THE QUALITY ASSURANCE PROGRAM AND THEIR RESPONSIBILITIES FOR DEVELOPMENT OF QUALITY ASSURANCE PROGRAMS

4.1. The Operator provides for arrangement and co-ordination of development and implementation of general and specific quality assurance programs at all stages of the Project.

For this the Operator should:

Select organizations carrying out works and rendering services to him;

Establish requirements for QAPs of organizations carrying out works and rendering services to him;

Examine compliance of QAPs of organizations carrying out works and rendering services to him with the established requirements;

Control and conduct internal audits of implementation of general and specific QAPs of the Project implementation that are under his responsibility;
Gather and analyze information on quality of the implemented works and rendered services;
Revise QAP(G).
4.2. Designer of the installation for SFA unloading from the Lepse DS should develop, approve and implement QAP(D)I.
4.4. Designers of equipment, articles and systems important to safety in course of the Project should develop, approve and implement QAP(D)E.
4.5. Manufacturers of equipment, articles and systems important to safety in course of the Project should develop, approve and implement QAP(M)E.
4.6. Organization erecting and commissioning the installation for SFA unloading from the Lepse DS should develop, approve and implement QAP(E)I and QAP(C)I.
4.7. Organization operating and decommissioning in future the installation for SFA unloading from the Lepse DS should develop, approve and implement QAP(O)I and QAP(Dc))I.
4.8. According to the approved plans the Operator should examine compliance of QAP(D)I, QAP(D)E, QAP(M)E, QAP(E)I, QAP(C)I, QAP(O)I and QAP(Dc)I with the established requirements.
4.9. Organizations carrying out works and rendering services to the Operator (contractors) should develop, approve and implement their own QAPs depending on the specific character of the fulfilled works and rendered services. Also they should make arrangements for and co-ordinate of development and examination of implementation of QAPs of sub-contractors carrying out works and rendering services to the contractors and their compliance with the established requirements.
4.10. The Operator and organizations carrying out works and rendering services to him should develop a procedure for estimation of the QAP effectiveness for assuring quality of the Project implementation.

5. REQUIREMENTS FOR THE CONTENT OF QUALITY ASSURANCE PROGRAM

5.1. QAPs of all participants in the Project for SFA unloading from the Lepse DS should be developed in compliance with the requirements for their content set up by this document. Information presented in QAP should provide for a confidence that design, construction, operation and decommissioning of the SFA unloading installation are carried out properly and comply with the specified requirements for quality assurance.
5.2. QAP(G) should consist of the sections according to Annex 1 and define requirements for specific quality assurance programs to be implemented by organizations carrying out works and rendering services to the Operator in their specific QAPs through the contractual relations with the Operator.
5.3. Specific quality assurance programs should consist of sections listed in Annex 1 (obligatory).
5.4. The Operator and/or organizations carrying out works and rendering services to the Operator are allowed not to include those Sections on quality assurance into QAPs, which correspond to activities that are outside the functions of those organizations.
5.5. The Operator provides for development of supplementary sections in comparison with QAP sections set up in Annex 1 depending on the specific character

of works.
5.6. If the Operator and/or organizations carrying out works and rendering services to him introduced quality system according to the International Standards of ISO 9000 and it was documented then the corresponding QAP can contain references to the appropriate documents (procedures, techniques).
5.7. QAP for each item of equipment or consignment of similar articles of the foreign origin should additionally contain references to documents confirming that the Operator, organizations carrying out works and rendering services to him or other sub-contractors met requirements of RD-03-36-97 (Terms and conditions for delivery of imported equipment, articles and completing items for nuclear facilities, radiation sources and storage facilities of the Russian Federation").

6. REQUIREMENTS FOR IMPLEMENTATION OF QUALITY ASSURANCE PROGRAM FOR THE PROJECT IMPLEMENTATION

QAP for the Project implementation is entered into force by the corresponding order of the Operator or the organization carrying out works and rendering services to him and becomes a standard.
General and specific QAPs for the Project implementation come into force before start of works regulated by the corresponding QAPs.
Methods for quality assurance specified by the QAP of the Project implementation should consider classification of equipment, systems and technologies according their effect on safety of the Project implementation defined by the Federal Rules and Regulations in the use of nuclear energy.
Content of procedures, statutes of structural units and job description of the workers (personnel) is specified by the Operator and organizations carrying out works and rendering services to him taking into account (if necessary) quality assuring provisions given in Annex 2.
Effectiveness of the general and specific QAPs is to be defined by conducting examinations (audits) of their implementation.
General and specific QAPs should establish procedure for insertion of necessary amendments into them.
The Operator should stipulate for examination (audit) of the implementation of specific QAPs developed by organizations carrying out works and rendering services to the Operator. Organizations carrying out works and rendering services to the Operator should stipulate for examination (audit) of the implementation of specific QAPs developed by organizations carrying out works and rendering services to them.
Both the Operator and organizations carrying out works and rendering services to him should conduct independent internal audits of implementation of QAPs for the Project fulfillment. Also they have to analyze QAPs and improve them.

7. REQUIREMENTS FOR CERTIFICATION OF THE USED EQUIPMENT, ARTICLES AND TECHNOLOGIES

7.1. Equipment and articles included imported ones used in the Project and affecting safety are to be certified in the System of certification of equipment, articles and technologies for nuclear installations, radiation sources and storage facilities according to the "Certification Procedure".
7.2. Specification for supplied equipment and articles used in the Project and

affecting safety are to be included into Design and Engineering Documentation of the Project (including Terms of Reference). Lists of characteristics (parameters) affecting safety and confirmed in certification are to be included into this documentation for the mentioned equipment and articles.

7.3. For equipment or articles being subject to certification QAP for the Project implementation should contain a complete list of regulatory (normative) or other documents (State and industry branch standards, specifications, engineering requirements). Certificates for equipment or articles should assure compliance with these documents. For equipment and articles to be certified on the basis of only some requirements of the mentioned documents, Sections or Items of these documents setting up quality requirements to be justified by the compliance certificates are to be indicated.

7.4. Certificates of compliance of equipment and articles being subject to certification with quality requirements set up in design and engineering documentation for the Project should be submitted by manufacturers (suppliers) of equipment and articles within a set of documents accompanying delivery of this equipment and articles.

7.5. The Operator, organization carrying out works and rendering services to the Operator and their sub-contractors are allowed to use equipment and articles being subject to certification only in case if compliance certificates issued in the System of certification of equipment, articles and technologies for nuclear installations, radiation sources and storage facilities are available for this equipment and articles. Equipment and articles being subject to certification and having the compliance certificates issued in other certification systems can be used by Operator, organization carrying out works and rendering services to the Operator and their sub-contractors only if these certificates are recognized in the System of certification of equipment, articles and technologies for nuclear installations, radiation sources and storage facilities according to the established procedure.

ANNEX 1
(obligatory)
SECTIONS OF QUALITY ASSURANCE PROGRAM FOR SFA UNLOADING FROM THE LEPSE DS

Due to the fact that safety regulation, state standards, international guides and Standards use the different terms and definitions it is expedient to proceed from the uniform definition of terms for presenting information in QAP. Therefore it is recommended to present the used terms and their definitions at the beginning of QAP.

1. Policy in the area of quality assurance

This section should present description of the general policy in the area of quality assurance adopted by the Operator and/or organizations carrying out works and rendering services to the Operator in implementation of the Project or its specific stages. This section should state:

Priority of nuclear and radiation safety ensuring;

Main goals of quality assurance;

Tasks aimed at achievement of the prescribed goals of quality assurance and methods for solving these tasks;

Obligations of the Management of the organization, developer of the corresponding QAP, to implement and introduce into the practical work QAP undertaken at its highest managerial level.

It is necessary to demonstrate that policy in the area of quality assurance is coordinated with other areas of activities of the Operator and/or organizations carrying out works and rendering services to the Operator.

2. Requirements for the content of sections of quality assurance programs

Information on the areas of activities for quality assurance should be presented in general and specific QAPs of the Operator and/or organizations carrying out works and rendering services to the Operator according to the table below.

The main requirements for information presented in QAP for each area are given in para. 2.1. – 2.20 of this document.

Types of activities for Quality assurance	Quality Assurance Programs							
	QAP(G)	QAP(D)I	QAP(D)E	QAP(M)E	QAP(E)I	QAP(C)I	QAP(O)I	QAP(Dc)I
1.	+	+	+	+	+	+	+	+
2.	+	+	+	+	+	+	+	+
3.	+			+	+	+	+	+
4.	+	+	+	+	+			
5.	+	+	+	+	+	+	+	+
6.	+	+	+	+	+	+	+	+
7.	+			+	+	+	+	+
8.	+	+	+			+	+	+
9.	+	+	+	+	+	+	+	+
10.	+		+	+	+	+	+	+
11.	+	+	+	+	+	+	+	+
12.	+	+	+	+	+	+	+	+
13.	+				+	+	+	+
14.	+			+	+	+	+	+
15.	+	+	+	+	+	+	+	+
16.	+					+	+	+
17.	+	+	+	+	+	+	+	+
18.	+	+	+	+	+	+	+	+
19.	+	+	+	+	+	+	+	+
20.	+	+	+	+	+	+	+	+

2.1. Arrangement of activities for quality assurance

2.1.1. Quality system.

Description of Quality System of the Operator and/or organizations carrying out works and rendering services to the Operator should be presented in this sub-section. The description should represent the following:

2.1.1.1. Structure of the Quality System.

2.1.1.2. A list of regulatory documents on quality assurance (or references to it) being in force in the Operator and/or organizations carrying out works and rendering services to the Operator. For example, Federal Rules and Regulations in the use of nuclear energy, state and branch standards, in-house standards and existing procedures of the quality system.

2.1.1.3. Description of the main documents of the quality system (quality guides: general and for individual types of activities, etc.).

2.1.1.4. Regulatory and managerial-methodical basis of the quality system. Procedures of quality systems planned for development to meet requirements of this document and adopted policy in the area of quality assurance.

2.1.1.5. Responsibilities of the parties for quality assurance.

2.1.1.6. Structure of the quality service units.

It is necessary to demonstrate that the applied quality system assures that:

2.1.1.7. System is efficient and is understood correctly by all service units affecting safety.

2.1.1.8. Quality problems are prevented but not revealed after occurrence.

Also the following should be presented:

2.1.1.9. Structure of the Operator as an organization of the highest level in the system of the overall management of quality.

2.1.1.10. Authorities, responsibility, direct functional duties that are executed directly by the Operator.

2.1.1.11. Infrastructure of the Operator formed by the specialized enterprises and organizations to which the Operator transfers a part of his functional duties, authorities and responsibility keeping for himself completeness of the overall responsibility without damage to the obligations and liability of the contractors.

2.1.1.12. Arrangements for works on establishment of the Operator infrastructure (selection, proficiency of suppliers and organizations rendering services, creation of the database with this information, assessment of their quality systems).

2.1.1.13. Measures that provide sufficient theoretical and practical training and certification of personnel carrying out activities affecting quality; accumulation and maintaining of the necessary experience, forming of safety culture. Procedure for staffing should be described. It is necessary to present information on insertion of requirements for proficiency and requirements for a scope of knowledge and skills of the personnel involved in activities affecting safety ensuring of implementation of the Project or its specific stages to the job descriptions of the personnel. Information on the existing procedures for the work with personnel with regard to the following should be presented:

Examination of knowledge and skills of the workers (personnel) involved in activities affecting safety ensuring of the Project or its specific stages;

Identification of the needs in training of the workers (personnel) and arrangements for training, refreshment training, advanced training and certification of the workers (personnel) including issuing of the corresponding certificates;

Fulfillment of analysis of the programs for training, refreshment training, advanced training and certification of the workers (personnel);
Keeping of records on training, refreshment training, advanced training and certification of the workers (personnel).
2.1.1.14. Documentation confirming effectiveness of the elements of the quality system as well as documentation relating to periodicity of audits of the quality system efficiency.

2.1.2. Arrangements for implementation of activities on quality assurance.

Organizational structures and description of the functional duties that show levels of the authority and lines of the internal and external interactions should be presented.
These diagrams and descriptions should also reflect:
Structure of the organization and structural units assuring safety as well as structure of other functional organizations carrying our works affecting qualify in design of the installation, manufacture of equipment, erection of the installation (mounting of equipment including commissioning), commissioning of the installation, tests, examinations and audits of the reporting documentation;
Diagram of the overall arrangements for design showing interactions of the Operator with the organization playing a leading role in design among those organizations that carry out works and render services to the Operator, as well as procedure for design approval;
Information on arrangements for audits and inspections of QAPs of the organizations carrying out works and rendering services to the Operator and procedure for their planning and conducting by the Operator and structural units of Gosatomnadzor of Russia;
A list of documents establishing the legal basis for activities of the Operator and organizations involved in QAP implementation and defining administrative-and-legal form of interrelations between these organizations;
Necessary information on compliance of the allocation of responsibilities for working out and implementation of QAP with requirements of this document;

Data demonstrating that control system of the Operator and links between the Operator and organizations carrying out works and rendering services to the Operator existing for all types of activities are effective for QAP implementation;
A list of the managerial positions for which authority and responsibility for implementation and effectiveness of general and specific QAPs are specified.

2.2. Quality Assurance Programs

2.2.1. Information on the development and formatting of QAPs (general and specific) and results of their audits should be presented according to requirements of this document.
2.2.2. Components, systems, equipment, elements or operations for which QAP is applied are to be indicated. It is necessary to present information demonstrating that any activity affecting systems and equipment important to safety is subject of the appropriate control within QAP.
2.2.3. Measures affecting quality and taken before development of QAP including Terms of Reference for Feasibility Studies, for design of equipment or installation, etc. are to be described.

2.2.4. Measures taken by the Operator for ensuring of QAP implementation are to be described.
2.2.5. Information on analysis of the regulatory-engineering support at all stages of the Project conducted by the Operator with involvement of organizations carrying out works and rendering services to the Operator is to be presented. Measures taken by the Operator to ensure development of the missed documents identified from the results of this analysis are to be given.

2.3. Management of purchases of equipment, devices, completing articles and materials as well as rendered services

2.3.1. It is necessary to present information on procedures for:
Arrangements for purchases of equipment, devices, completing articles and materials as well as for service rendering including procedure for selection of organizations carrying out works and rendering services to the Operator (arrangement of tender);
Keeping of documentation on purchasing of equipment, devices, completing articles and materials as well as for service rendering;
Audits of QAPs of organizations carrying out works and rendering services to the Operator and assessment of their ability to carry out works or render services to the Operator;
Analysis of the contracts for purchasing of equipment, completing articles and materials as well as for service rendering.
2.3.2. Criteria applied in the procedures for assessment of suppliers or contractors are to be described, including:
Availability of the permission for activities carried out by them (design, engineering, and manufacture) issued by Gosatomnadzor of Russia;
Presence of the positive experience in elaboration and manufacture of similar articles confirmed by experience of safe operation;
Results of estimations of technical abilities and quality system of the supplier or contracted organization.
2.3.3. Measures ensuring consideration of the following requirements specified in the initial data, in particular in Terms of Reference, are to be described in this sub-section:
Directive on the necessity of the specific QAP working out;
Technical requirements (applicability indicators);
Requirements for tests, inspection and acceptance;
Systems of permissions for access to articles and documentation with a purpose to control and customer's inspection;
Indication of requirements for quality assurance and sections of the customer QAP applied to the supplied equipment or services;
Indication of the necessary documentation (manuals, procedures, reports (protocols) of inspections and tests, etc.) for consideration of the quality indicators to be developed and submitted for review or approval by the customer;
Statement on the controlled distribution, storage, keeping and withdrawing of registration cards for accounting for quality indicators;
Requirements for elaboration of reports and approval of measures relating to elimination deviations from the quality assurance standards;
Statement on indication of dates for documentation submissions;

Requirements for ensuring of reliability, safety, etc. associated with Policy of the Operator in the area of quality assurance.
2.3.4. It is necessary to describe procedures or give references to the appropriate techniques of the input control of the supplied equipment, devices, completing articles and materials as well as rendering services at all specified stages.

2.4. Control of the delivery documents
2.4.1. Procedures for review of documents on delivery of articles or providing services established and controlled by the Operator are to be described. The purposes of this review are:
To define that terms and conditions for elaboration, review, co-ordination and approval are met;
To get guarantees that all necessary requirements, main criteria for design, requirements of audits and tests, as well as other requirements for quality assurance are included into the documents;
To define if quality requirements have been established correctly and can be checked.
2.4.2. Allocation of responsibilities among the Operator and organizations carrying out works and rendering services to him are to be presented for:
Working out, review, co-ordination and control of documents on delivery of articles and services;
Selection of the suppliers;
Review and co-ordination of QAP of the suppliers before starts of the works falling under this program.
Information should be presented with consideration of the development and implementation of QAP(G) and corresponding specific QAPs of both the Operator and organizations carrying out works and rendering services to him.

2.5. Manuals, techniques and drawings
This sub-section should present information on the allocation of the administrative responsibility and availability of the system which both should ensure that instructions, procedures and drawings include qualitative and quantitative acceptance criteria on compliance of implementation of the safety important works with the previously established requirements.

2.6. Management of documentation
Information on the program for documentation control developed by the Operator should be presented including:
Area of applicability of the control program that is types of the controlled documents (design documentation, drawings, instructions and techniques, SARs, reports on specific subjects, quality assurance guides, reports on disparities, etc.);
Procedures for development, review, co-ordination, approval and enacting (issuing) of the documents, insertion amendments into them, revision, distribution, storage and disparaging of the documents losing their force;
Procedures ensuring that changes incorporated into the document are reviewed and coordinated by the same organizations that coordinated the initial documents;
Procedures ensuring availability of necessary documents at working places before start of the relevant works;
Procedures ensuring timely removal of the replaced documents;

Procedures defining timely elaboration of the engineering documentation with a purpose of the precise reflection of the actual state of the Project;
An order for the planned audits of the document status;
An order and planning of development of the missing procedures of the quality system.

2.7. Inspection control

Information on the existing procedures for checking compliance of the implemented works and rendered services with the established requirements should be presented, including:
Lists of the inspections
Existence of the programs for inspections
Schedule for the planning of inspections and compliance with it
Description of the administrative responsibility
Existence of programs and methods for training of the personnel conducting
Confirmation of the independence of the inspectors of the inspected
Existence and implementation of QAP
Directive on the order for conducting inspections of the process control points, stages of the work implementation after which the further works are prohibited without conducting of inspections and availability of the written permission based on the results of control and inspections

Providing fulfillment of inspection of each operation where quality assurance is required.

2.8. Control of design (development) of the installation (equipment)

2.8.1. Measures (procedures) planned and implemented by the Operator within QAP(G) and organizations carrying out works and rendering services to him – within specific QAPs in design of Installation (equipment) are to be described in this sub-section. They have to provide for check and control of:
Compliance of the design with requirements of the Terms and Reference, Federal rules and regulations in the use of nuclear energy;
Correctness of the adopted solutions and their compliance with the design requirements;
Quality assurance of the design and computational works confirming correctness of the adopted design solutions.
2.8.2. Information on the control of design works should include in particular the following:
Analysis of the necessity and further implementation of the initial design requirements - in a composition of the Terms and References for design (elaboration) of the installation and equipment. Attention should be drawn to safety and reliability requirements;
Description of the applied methods of control (verification), such as review of the design using the alternative computations or tests with justification of the method of the control (verification);
Analysis of compliance with requirements set up for organizations or officials responsible for verification and confirmation of the design data;
Analysis of compliance with requirements for recording of the verification results aimed at a possibility to examine or audit method of verification (control) upon its completion;

Analysis of compliance with requirements for the dates of verifications that have to be completed after qualifying tests of experimental or pilot model before issuing documentation for manufacture;
Information on compliance with criteria on obligingness of test conducting used for verification of the design and necessity of the providing for representative tests and modeling of the worst conditions defined on the basis of safety analysis.
2.8.3. Measures for identification and control of division (internal and external) of works in design (elaboration) of the installation (equipment) should be described. Planes-schedules for work implementation, protocols on division work and other documents applied for planning of and reporting on the work implementation can be used as a format of documentation establishing division of the works.
2.8.4. Measures taken for providing the control of insertion of changes into the design appeared in the processes of design, manufacture and operation of the installation and equipment.

2.9. Quality assurance for software, computational techniques and computation works

2.9.1. This section should include:

A list and description of the computer codes and techniques used for justification of the process parameters and parameters of the individual operations relating to safety of implementation of the Project or its specific stages;
References to the documents confirming certification of the mentioned software and techniques by the Board of Gosatomnadzor of Russia for the software certification;
Information on existing procedures for quality assurance in the use of the mentioned software and computational techniques (verifications and evidences of applicability of this software for those specific tasks within the Project for that resolving this software was used, selection of the acceptable calculation assumptions, verification of the specific calculation results received, etc.).
2.9.2. Arrangement for computation works and the following measures for quality assurance are to be described:
Organizational structure, division of the works (internal and external), functional duties, authority and administrative responsibility of the executors, experts, managers, etc.) for the qualitative implementation of the computational works;

Procedure for improvement of the used software;
Procedure for improvement of the professional skills of the executors;
Procedure for the use of the certified databases for the computations;
Data on the use of the applied computer codes for automation of issuing of the reporting documentation;

Procedure for familiarization with and introduction of the alternative computer codes and techniques;
Updating of computational techniques and software used in the design (elaboration) of the installation (equipment).

2.10. Identification and control of the purchased equipment, devices, completing articles and materials and rendered services

Information on measures for identification and control of the purchased equipment, devices, completing articles and materials as well as rendered services to fully avoid use of equipment, devices, completing articles and materials which do not comply with requirements or have defects and use of services which do not comply with the

established quality requirements.

The following procedures are to be described:
Arrangements for identification, control (including input control) and tests of equipment, completing articles and materials;
Providing for the tracability of the results of control and tests;
Providing for completeness of types of control and tests;
Arrangements for control over compliance with requirements to the rendered services.
Information presented here should include allocation of the administrative responsibility.

2.11. Process control

2.11.1.A list and description of processes directly affecting quality of products and services and procedures for their implementation with compliance of the specified quality requirements are to be presented. This list should contain in particular the following main processes important to safety ensuring of the Project:
Mechanical treatment and assembling of equipment and units of the installation important to safety which affect quality of the complete products;

Cleanness ensuring in production;
Welding, cladding and thermal treatment;
Applied methods of non-destructive testing;
Mounting of equipment and units of the installation affecting safety;
Removal of casings with SFA from tanks of the Lepse store;
Drying of casings;
Placing casings into container and sealing of the containers;
Testing of container integrity;
Placing containers into the casks;
Transfer of casks to storage facilities specified by the Project for the interim storage of casks with SNF unloaded from Lepse anticipating their further transport to outside the boundaries of the Operator site;
Repair of the installation and equipment and their maintenance during operation;
Decontamination of equipment and units of the installation affecting;
Treatment of the generated secondary radioactive waste after completion of SFA unloading from Lepse.
2.11.2. Information on the following matters should be presented for each process directly affecting quality of products and services:
Preparing of a list of systems (components) important to safety;
Existing of requirements for quality of systems (components) important to safety in implementation of the Project or its specific stages;
Order and ways for fulfillment and control of works affecting safety in implementation of the Project or its specific stages;
Implementation of maintenance and repair of equipment.
2.11.3. Information on procedures for control of the processes and implementation of the specific QAPs should be presented including the following:
Description of administrative responsibility including responsibility of quality service units of the enterprise;
Analysis of implementation of the qualification tests, results of certification of personnel and equipment concerned to fulfillment of processes with involvement of quality service units;

Keeping of records confirming quality of the process implementation;
An order of conducting audits and inspections to control processes by the Operator;
Keeping of records confirming quality of the final products.

2.11.4. Measures ensuring compliance of the following requirements for process quality are to be described:
Implementation of measures during design on ensuring processability as applied to all stages of the service lifetime of the product;
Specifying of the fundamental (in terms of ensuring of the qualitative parameters of the design of installation and equipment affecting safety) requirements and methods of control of engineering documentation;
Results of refinement of new processes, adaptation of the process equipment, techniques and means of control;
A list of administrative measures and engineering activities to ensure control reliability, results of the metrological support of the reference operations at all stages of the Project implementation;
A list of measures for staffing of the process and metrology service units with qualified specialists.

2. 12. Control of tests

Information on the existing procedures ensuring completeness of a set of types of tests and testing of equipment, articles and systems important to safety in implementation of the Project or its stages is to be presented.

2.12.1. A list of tests necessary for examination and confirmation of the operability of the mentioned equipment and systems during operation is to be presented for these equipment and systems.
2.12.2.Completeness and adequacy of consideration of the following conditions and requirements in the Programs of tests are to be shown:

Adopted model of operation of equipment, articles and systems;
Requirements for the metrology support to tests;
Conditions (criteria) of acceptance of the results of tests;
Requirements for the tests representation.
2.12.3. Methods for fixing and recording of the results of tests and evaluation of their acceptance are to be described.
2.12.4. QAP(E)I, QAP(C)I, QAP(O)I and QAP(Dc)I should have references to the reports on conducted tests and testing of the mentioned equipment, articles and systems at the Project stages completed before start of construction, commissioning, operation and decommissioning of the installation for SFA unloading from Lepse taking into consideration implementation of QAP(G) and specific QAPs at these completed stages. The results of these reports are to be described briefly.

2.13. Examination of the measuring and control instrumentation, and testing equipment and devices (metrology support)

This section should contain information on the existing procedures for the following:
Arrangements for qualification, calibration, adjustment and identification of the control and measuring and test equipment and devices;
Keeping, registration and storage of the records (reports) for qualification, calibration and adjustment of the control and measuring and test equipment and devices.

Information on the programs for examination of the control and measuring instrumentation at all stages of the Project implementation should be presented including in particular:
Area of applicability of the examination program, existence of the list of the inspected equipment and devices;
Description of allocation of the administrative responsibilities and responsibilities of the quality service units;
Existence of the Statement on identification of the control and measuring and testing equipment and devices;
Compliance with requirements for calibration of equipment and periodicity of its further calibrations;
Compliance with requirements for the model (calibrating);
Checking of compliance of the calibration standards with the adopted national or international standards;
Conduction of audits of the metrology support by the Operator.

2.14. Treatment of equipment, its storage and transport

Information on procedures of QAP(G) and specific QAPs for compliance with special requirements for management, mothballing, storage, decontamination, packaging and transport of equipment is to be presented, including information on the following procedures:
Control of compliance with the instructions of the supplier and specifications for treatment, storage and transport of the equipment;
Existence of procedures for control over treatment, storage and transport of the equipment;
Existence of methods of control in treatment, storage and transport of equipment;
Control of equipment before its shipment;
Procedure for implementation of the appropriate inspections and audits by the Operator.

2.15. Ensuring of reliability

This section should contain information on the existing procedures for arrangements for reliability ensuring of equipment, articles and systems important to safety in implementation of the Project or its specific stages sufficient for demonstration of the efficiency of measures for reliability ensuring of the mentioned equipment and systems.
2.15.1. A list of equipment and systems being subject to requirements for reliability ensuring should be presented.
2.15.2. Responsible organizations carrying our activities on reliability ensuring within the scope prescribed for the by the Project are to be indicated.
2.15.3. An order of interactions and diagram of the organizational structure of participants of reliability ensuring activities are to be presented.
2.15.4. If the standard procedures for reliability ensuring for equipment and devices of the serial production are available, they have to be given in the Annex to the corresponding QAP.

2.16. Examination, tests and operational status of the equipment

2.16.1. Information on procedures establishing an order for conducting of examinations and tests of equipment and installation in a course of manufacture, mounting, tests and operation of equipment and installation should be presented.

2.16.2. Information on procedures for certifying (indication) of the operational state of equipment and installation (use of the marks, label-tags, routing maps, stamps, etc.) is to be presented.
2.16.3. Measures for control over changes in the sequence of the required tests of equipment and installation, examinations and other operations important to safety are to be described.
2.16.4. Measures providing for the right indication of the working position of equipment and gears (for example, valves and switches) are to be described.
2.16.5. Measures ensuring necessary recording of the state of equipment and revealed disparities (noncompliance) should be presented.

2.17. Control of disparities

2.17.1. This section should contain information on the existing procedures for:

Registration of noncompliance with requirements for quality of the work implementation and/or quality of equipment (errors of design and manufacture, defects and failures of equipment, violation of the operational modes, personnel errors and others) and their analysis;

Impossibility to use products which do not comply with the established requirements (procedure for separation, retrieval, recording and identification of such products;

Arranging of a system for gathering and processing of data on disparities (noncompliance), violations, defects, causes of their occurrence, corrective measures taken.

2.17.2. Information on the system for gathering and processing of data on violations and causes of their occurrence, written establishment of the order to exchange information on violations and information on rules for analyzing causes of their occurrence is to be presented. Information on the order of notification on violations and corrective measures taken of the respective authorities and Gosatomnadzor of Russia is to be given.
2.17.3. Procedures for identification, recording and notification of the respective organizations on the revealed noncompliance of materials, equipment and components should be described (or references to them are to be given). Description of the administrative responsibility of the quality service units and other organizations for identification and implementation of activities relating to control of disparities (noncompliance) is to be presented.
2.17.4. Information on the procedure for decision making with regard to the revealed disparities and results of the control of the appropriate implementation of these decisions conducted by the quality service units should be presented.
2.17.5. Information on procedures for analyzing of noncompliance by the Operator is to be presented.

2.18. Corrective measures

2.18.1. This Section should contain information on the existing procedures for working out of the corrective measures to avoid recurrence of disparities revealed on the results of examinations (inspections), control of the implementation of the corrective measures and estimation of their effectiveness. Information on procedures for recording of the corrective measures after identification of factors negatively affecting quality, such as failures, faults, defects, deviations and other disparities is also to be presented in this section.

2.18.2. Effectiveness of these procedures should be shown. The role and responsibility of the quality service units in identification of causes for disparity occurrence and necessary corrective measures should be indicated.
2.18.3. Information confirming recording of the main reasons for implementation of the corrective measures, these measures themselves taken to avoid recurrence of the disparities and reporting to the Management of the enterprise and the Operator for review and assessment should be presented.

2.19. Documentation (records) on quality assurance

This Section should contain information on the existing procedures for establishing and keeping of documentation on quality assurance – prescription of the type of a record (depending on importance), identification, gathering, indexing, access, creation of the card-index, storage, keeping and disparaging of the registered data on quality including results of the inspections, examinations of the process, analysis of the supplied equipment, completing articles and materials.
2.19.1. Documentation reflecting results of QAP implementation – objective information on quality including results of examinations, inspections, audits, checks of the processes and operational indicators, analysis of materials, as well as relevant data such as professional skills of the personnel, statements of the methodological documents, regulations and guidelines, should be described.
2.19.2. An order for control of the overall information flow exchanging between organizations, enterprises and their structural units (offices) should be described.
2.19.2. The following information should be presented:
A list of persons and organizations responsible for development, approval and issuing of the documents;
A list of the corresponding documents that are to be applied at different stages;
Procedure for co-ordination and control of documents establishing division of the works (internal and external);
Procedure for confirming the rightness of the actual use of the documents, receiving of the most recent documents, returning of the obsolete versions or their marking to avoid their accidental use.
2.19.3. Conditions for works on collection, storage and issuing of documentation that should be kept in compliance with the procedures established in written form are to be described. Requirements for the sufficient number of documents, for including of data on the status and results of works affecting safety and the main operational conditions into the documents are to be reflected in the procedures. Information on documentation system for collection, identification, indexing, placing, storage, keeping and disparaging of the documents should be presented.
2.19.4. System for reporting on QAP implementation, in particular including the following, is to be described:
Elaboration of the reports on the results of the fulfilled examinations on the use of documents, quality of the elaborated products, quality coasts, assessment of reliability (confidence), etc.

Preparation of the annual reports on product quality for the specified period.

Preparation of the annual reports on the results of implementation of the author's supervision in the design, mounting, tests and operation.

2.19.5. An order for and planning of development of the missing procedures of the quality system are to be described.

2.20. Verifications (audits)

Information on the existing procedures for fulfillment of the independent audits (internal and external) of the actual status of QAP implementation for the Project or its specific stages and for assessment of the QAP effectiveness, as well as procedures for formatting the results of these audits should be presented in this Section.

2.20.1. Measures providing for conducting of audits intended for identification of the actual state of QAP and its effectiveness are to be described.

2.20.2. Procedure for fulfillment of the QAP audits providing in particular the following should be described:

Verification of existence of the main provisions, techniques, an order of work implementation and instructions assuring quality in design, manufacture, erection, commissioning and decommissioning;

Identification of the availability of the appropriate information (initial design data and documents);

Verification of insertion of quality requirements to design and engineering documentation;

Verification of the efficiency of the control over development of documentation and changes introduced into it;

Recording of audits (verifications) results.

2.20.3. System of inspections and audits both external (implemented by the Operator and Gosatomnadzor of Russia) and internal (conducted by the organization implementing QAP) is to be described.

2.20.4. Schedules of the QAP(G) should present information on audits stipulated for by the Operator.

ANNEX 2

(recommended*)*

THE MAIN SECTIONS OF PROCEDURES, STATUTES ON THE STRUCTURAL UNITS AND JOB DESCRIPTIONS

1. CONTENT OF PROCEDURE FOR IMPLEMENTATION OF THE WORKS

The following should be reflected in the procedure for work implementation:
1.1. Title of the procedure with a note on its safety importance in implementation of the Project or its specific stages.
1.2. Objective of the procedure.
1.3. Area of applicability of the procedure.
1.4. Requirements for quality of works with indication of documents regulating them or requirements of the customer.
1.5. Corrective measures in case of disparities revealing.
1.6. List of materials and tools necessary for implementation of works.
1.7. Precaution measures during work implementation, which avoid the negative effect of these works on safety in implementation of the Project or its specific stages.
1.8. The required professional skills of the responsible leader (supervisor) and work executors.
1.9. An order of work implementation with indication of the control operations and control points. Permission for continuation of the works issued by the responsible leader of the works is required after completion of the control operations.
1.10. Periodicity and order for revision of the procedure.

2. CONTENT OF PROCEDURE FOR CONTROL OF WORK IMPLEMENTATION
The following should be reflected in the procedure for control of work implementation:
2.1. Title of the procedure with a note on its safety importance in implementation of the Project or its specific stages.
2.2. Objective of the procedure.
2.3. Area of applicability of the procedure.
2.4. Control operations after which completion the permission on continuation of works issued by the responsible leader (supervisor) is needed and control points.
2.5. Requirements for quality of works with indication of documents regulating them or requirements of the customer.
2.6. A list of materials, administrative measures and technical means necessary for control.
2.7. Precaution measures during work implementation, which avoid the negative effect of these works on safety in implementation of the Project or its specific stages.
2.8. Order of conducting of the control operations with references to the approved techniques for control.
2.9. The required professional skills of the responsible leader (supervisor) and work executors.
2.10. Periodicity and order for revision of the procedure.

3. CONTENT OF STATUTE ON THE STRUCTURAL UNIT
Statute on structural unit involved in activities important for safety ensuring in implementation of the Project or its specific stages should describe:
3.1. A list of works the structural unit is responsible for.

3.2. Functions of the units in the area of work implementation.
3.3. Types and areas of activities for quality assuring in implementation of works and order of implementation of these activities.
3.4. A list of other structural units involved in work implementation and an order of interactions with them.
3.5. Periodicity and an order for revision of the statute.

4. CONTENT OF JOB DESCRIPTION FOR THE WORKERS (PERSONNEL)
Job descriptions for the workers (personnel) including administrative and engineering staff involved in fulfillment of works important to safety ensuring in implementation of the Project or its specific stages reflect the following:
4.1. A list of works to be carried out according to the position taken.
4.2. Duties of the worker in implementation of the works including duties for assuring quality of the works.
4.3. Professional skills and a list of knowledge and experience necessary for implementation of the duties.
4.4. Periodicity of examining of knowledge and experience and an order for maintaining professional skills.
4.5. Periodicity and an order for revision of the job description.

5. CONTENT OF PROCEDURE FOR MANAGEMENT OF THE WORK QUALITY
Procedure for management of the work quality presents the following:
5.1. Title of the works to be managed with indication of boundaries for the ad hoc intervention.
5.2. Control points and operations after which completion permission for continuation of the work issued by the responsible leader of the works is required.
5.3. Criteria on quality of the works with indication of the documents regulating these works or requirements of the customer.
5.4. Ways, means and an order for the ad hoc gathering, analysis and assessment of information on quality of the implemented activities with a purpose to quick development and implementation of the adequate corrective measures.
5.5. An order for the ad hoc development and implementation of the corrective measures for elimination or prevention of the revealed disparities including those revealed in investigations of the events in implementation of the Project or its specific stages.
5.6. Periodicity and an order for revision of the procedure.

6. CONTENT OF THE PROCEDURE FOR EXAMINATION OF THE GENERAL AND SPECIFIC QUALITY ASSURANCE PROGRAMS

Procedure for examination of general and specific QAPs in implementation of the Project or its specific stages indicates periodicity and an order for revision of the procedure, conditions for conducting of the extraordinary examination and reflects the following provisions:
6.1. All activities for quality assurance of implementation of works important to safety in implementation of the Project or its specific stages stated by the QAP are subject to examination (audit).
6.2. The reporting document should present the following:

6.2.1. Results of analysis of the disparities revealed during the reported period including disparities revealed in investigation of events in implementation of the Project or its specific stages.
6.2.2 Estimation of effectiveness of quality assurance activities for a set of works stipulated for implementation.
6.2.3. Recommendations for all executors of works on improvement of activities for quality assuring in implementation of works.

APPENDIX D

Guidance on a safety

Federal Nuclear and Radiation Safety Authority of Russia
(Gosatomnadzor of Russia)

SAFETY GUIDES

Approved by Decree
of Gosatomnadzor of Russia
dated “05” April 2001
№ 5

REQUIREMENTS FOR NUCLEAR AND RADIATION SAFETY ANALYSIS REPORT FOR UNLOADING OF SPENT FUEL ASSEMBLIES IN IMPLEMENTATION OF THE INDUSTRIAL LEPSE PROJECT

RB-016-01

(UNOFFICIAL TRANSLATION)

COMES INTO FORCE
on 05 June 2001

MOSCOW, 2001

UDK 629.124.5 : 621.039

Requirements for Nuclear and Radiation Safety Analysis Report for Unloading of Spent Fuel Assemblies in Implementation of the Industrial Lepse Project

RB-016-01
Gosatomnadzor of Russia
Moscow, 2001

This Safety Guide has been developed according to the Federal Rules and Regulations (Norms and Rules) in the use of nuclear energy. They are the following: “Requirements for Safety Analysis Report for nuclear power installations of Ships” (NP-023-2000) and “Safety Rules for storage and transfer of nuclear fuel at nuclear power engineering facilities” (PNAE G-14-029-91). Specific character of works onboard Lepse and technical condition of Lepse was taken into consideration.

Lepse Depot Ship is a service ship for nuclear-powered icebreakers of the Open Joint-Stock Company “Murmansk Shipping Company” (MSCo) and is based in the berth of State Unitary Repair-process enterprise GU RTP “Atomflot”.

Federal Rules and Regulations “Requirements for Safety Analysis Report for NPP with VVER-type reactors” (PNAE G-01-036-95) and “Requirements for Safety Analysis Report for NPP with fast breeders” (NP-018-200) and NP-023-2000 were taken as a methodology basis of this Safety Guide.

This document defines requirements of Gosatomnadzor of Russia for the Report justifying nuclear and radiation safety (Safety Analysis Report) during unloading of spent fuel assemblies from the store of Lepse DS. Gosatomnadzor of Russia uses information from this Report to assess adequacy of safety ensuring during unloading of spent fuel assemblies from the store of Lepse DS. The purpose of this evaluation is to avoid noncompliance with nuclear and radiation safety requirements and exposure exceeding the authorized dose limits for Lepse workers (crew), population and the environment during normal operation and in case of events.

There are some peculiarities of maintenance of safety status of activities for unloading of spent fuel assemblies at the permissible level. Equipment of the Lepse storage facility is in a bad condition. A part of spent fuel assemblies is damaged and their unloading by the standard equipment is impossible. Therefore special unloading equipment is to be developed. Requirements for this equipment are set up in this document.

This document is issued for the first time.

This document has been developed by V.P. Slutsker, V.N. Tchukanov, V.P. Shempelev and A.Ya. Shulgin from SEC NRS with participation of S.Yu. Korshunova, V.G. Markarov and I.M. Pluzhnikov from Gosatomnadzor of Russia, as well as O.I. Panov and N.F. Filippov from the North-European

Regional Office of Gosatomnadzor of Russia, M.K. Aturin and A.V. Markarov from Mintrans of Russia, V.I. Volkov and B.M. Kopylov from MSCo, S. Fowell and G. Smith, consultants from the UK, M.K. Sneve and T. Sekse from NRPA (Norway), K. Bergman (SIP, Sweden), M. Westerlind (SKI, Sweden) and L. Malmqest (SSI, Sweden).

TABLE OF CONTENTS

LIST OF ABBERIVATIONS USED IN THIS GUIDE 78
TERMS AND DEFENITIONS 79
1. GENERAL PROVISIONS 80
1.1. Purpose and applicability of the report 80
1.2. Procedure for development, submission and updating of Safety Analysis Report 81
1.3. Requirements for the content and format of Safety Analysis Report . 81
2. GENERAL DESCRIPTION OF THE LEPSE DS 83
2.1. Technical parameters of the Lepse DS. 83
2.2. The main results of the depot ship survey before start of the SFA unloading operations 83
2.3. Concept of the safe unloading of SFA. 84
2.4. General description of the set of equipment used for SFA unloading. 84
2.5. Assurance of the depot ship survivability. 84
2.6. Content of SAR for SFA unloading. 84
3. NUCLEAR AND RADIATION SAFETY 85
3.1. Main principles and criteria of safety ensuring during SFA unloading. 85
3.2. Nuclear safety ensuring. 87
3.3. Providing for heat removal inside the storage tanks. 88
3.4. Radiation safety ensuring. 88
4. SAFETY SYSTEMS (COMPONENTS) 92
4.1. Classification of Safety Systems (components). 92
4.2. Description of safety systems (components). 92
4.3. Results of the quantitative safety analysis 92
4.4. Control safety systems (components). 93
4.5. Protective safety systems. 94
4.6. Confining safety systems. 95
4.7. Support Safety Systems. 95
4.8. Systems (components) used in SFA unloading operations and not affecting safety. 95
5. INSTALLATION FOR SFA UNLOADING AND UNLOAING TECHNOLOGY 96
5.1. Description of the composition of a set of equipment. 96
5.2. A composition of a set of the operating documents. 97
5.3. Description of SFA unloading operations. 97
6. SAFETY ANALYSIS OF SFA UNLOADING 98
6.1. A list of Initiating Events of violations in technology of SFA unloading. 98
6.2. Analysis of accidents considered by the SFA unloading technology. 100
6.3. Analysis of beyond the design basis accidents. 100
7. LIMITS AND CONDITIONS FOR SAFE SFA UNLOADING, OPERATIONAL LIMITS OF SYSTEMS (COMPONENTS) OF THE SFA STORAGE 102
7.1. Limits of safe operation. 102
7.2. Operational limits 102
7.3. Conditions of safe operation of systems (components). 103

7.4. Administrative conditions and recording of data on control of limits and conditions for safe operation of systems (components). Control of observance of operational limits and conditions. 103
8. TRAINING OF PERSONNEL OF THE DS, OPERATION AND MAINTENANCE OF SYSTEMS (COMPONENTS) 105
8.1. Changes in the organizational chart. 105
8.2. Selection and training of workers (personnel) of the DS. 105
8.3. Maintenance of systems (components) 106
8.4. Observation in the period of inactivity. Ad hoc documenting. 106
9. QUALITY ASSURANCE 107
10. ARRANGEMENT OF ACTIVITIES FOR SFA UNLOADING FROM THE DS STORAGE. EMERGENCY PREPARADNESS 108
10.1. Organizational chart of the Operator. 108
10.2. Physical protection system. 108
10.3. Emergency measures. 108
10.4. Management of emergency measures. 109
ANNEX 1. REQUIREMENTS FOR THE FORMAT OF SAR 111
ANNEX 2. RECOMMENDED STANDARD DESCRIPTION OF SAFETY SYSTEMS (COMPONENTS) AND SYSTEMS IMPORTANT FOR SAFETY DURING SFA UNLOADING OPERATIONS 112
ANNEX 3. RECOMMENDED MINIMUM LIST OF INITIATING EVENTS ... 116
ANNEX 4. RECOMMENDED SEQUENCE OF PROCESS ANALYSIS IN CASE OF VIOLATIONS IN SFA UNLOADING TECHNOLOGY AND ACCIDENTS CONSIDERED BY THE SFA UNLOADING TECHNOLOGY. 117
ANNEX 5. RECOMMENDED SEQUENCE OF ANALYSIS OF BEYOND THE DESIGN BASIS ACCIDENTS 120

LIST OF ABBERIVATIONS USED IN THIS GUIDE

CSS	- Confining Safety System
CTSS	- Control Safety System
DS	- Depot Ship
IE	- Initiating Events
K_{eff}	- Neutron multiplication factor
O	- Operator
PSS	- Protective Safety Systems
RAW	- Radioactive Waste
RD	- Regulatory (Normative) document
RM	- Radiation Monitoring
RS	- Radioactive Substance
SFA	- Spent Fuel Assembly
SIR	- Sources of Ionizing Radiation
SIS	- Safety Important System
SS	- Safety System
SCNR	- Self-sustaining chain nuclear reaction
SSS	- Support (Service) Safety System

TERMS AND DEFENITIONS

1. ACCIDENT CONSIDERED IN THE TECHNOLOGY OF SFA UNLOADING (DESIGN BASIS ACCIDENT) – accident, for which a technology of SFA unloading defines initiating events and final states. The technology also provides for Safety Systems ensuring that limits set up for the consequences of this accident will not exceed limits prescribed for such accidents.

2. BEYOND THE DESIGN BASIS ACCIDENT – an accident caused by initiating events which are not considered by the technology of SFA unloading or followed by additional failures of SS or human errors.

3. CONDITIONS FOR THE SAFE SFA UNLOADING – conditions prescribed by the SFA unloading technology. They define an optimal number of systems (components) important for safety, their characteristics, status of operational reliability and maintenance mode that are necessary to ensure compliance with safety criteria and/or limits for the safe SFA unloading.

4. DEPOT SHIP SITE – a territory and water area in the vicinity of the DS where changes in the level of radiation are possible due to releases and discharges of RS during work implementation. RM means of the Lepse DS and GU RTP “Atomflot” are used to implement permanent monitoring of radioactivity there.

5. INDICATORS OF THE FACILITY STATUS – a minimal set of safety parameters defining a state of the facility with the specified probability.

6. LIMITS OF THE SAFE UNLOADING OF SFA – values of the parameters of the harmful factors arising during SFA unloading prescribed by the unloading technology. Deviations from these values can result in the design basis accidents.

7. PREPARATION OF THE STORAFE FACILITY FOR DECOMMISSIONING – a set of measures to put the DS into nuclear and radiation safe conditions and her preparation for dismantling and recycling.

8. PROCESS LIMITS OF SFA UNLOADING – values of parameters and characteristics of a status of systems (components) of the SFA storage defined by the technology of SFA unloading. Deviations from these values can result in the design basis accidents.

9. WORKERS (CREW) OF THE DEPOT SHIP – permanent and other members of the depot ship’s staff implementing SFA unloading, maintenance of the ship systems and SFA unloading equipment.

1. GENERAL PROVISIONS

1.1. Purpose and applicability of the report

1.1.1 This document “Requirements for Nuclear and Radiation Safety Analysis Report for Unloading of Spent Fuel Assemblies in the Implementation of the Industrial Lepse Project (hereinafter Requirements) defines requirements for the procedure for development, submission, updating, structure and content of Nuclear and Radiation Safety Analysis (Justification) Report for Unloading of Spent Fuel Assemblies (hereinafter SAR).

1.1.2 This Guide has been developed in compliance with provisions of the Federal Laws “On the Use of Nuclear Energy” “On Protection of Population against Radiation” and other regulations (normative documents) in the use of nuclear energy.

1.1.3 The Applicant producing SAR has a right to use other ways and methods to justify safety than those given in this document. In this case the Applicant should demonstrate that the methods he used provide for at least the same adequacy level of safety ensuring.

1.1.4 This Guide defines structure and content of SAR that is to be submitted to Gosatomnadzor of Russia among the other documents justifying nuclear and radiation safety ensuring for activities declared by the Operator in its licence application.

1.1.5 SAR has to contain justified and complete information for the adequate understanding of safety of SFA management and formulate problems of safety ensuring for SFA unloading and safety concept, which is the basis for the design.

1.1.6 This Guide includes systematic analysis of the regulatory, technical and administrative aspects of safety of SFA unloading from the Lepse storage. The purpose of this analysis is to justify that the risk of exposure to radiation for the workers (crew) of the depot ship, population and the environment caused by the implemented activities is certainly within the limits specified by the regulations.

1.1.7 Information presented in SAR should provide Gosatomnadzor of Russia with a possibility to evaluate adequacy of safety justification for SFA management during their unloading. The objective of SFA management during unloading is to avoid an occurrence of SCNR and exceeding of the prescribed doses of the personnel and population exposure and authorized limits for the content of radioactive nuclides in the environment.

1.1.8 This Guide is applicable for operations of SFA unloading from the Lepse storage and is intended to be used by:

- The Operator carried out SFA unloading;
- Organizations implementing works and rendering services to the Operator;
- Structural Units of Gosatomnadzor of Russia fulfilling State supervision of the Project implementation and licensing of activities.

1.2. Procedure for development, submission and updating of Safety Analysis Report

1.2.1 The Operator develops and updates SAR during the preparatory stage of SFA unloading.

1.2.2 Safety justification of the use of special equipment designed and manufactured according to Terms of Reference should reflect the current status of its readiness at the moment of SAR submission to Gosatomnadzor of Russia.

1.2.3 All changes in the status of the ship, SFA storage, SFA unloading technology and implementation of stages for preparation of SFA unloading equipment appeared after the first submission of SAR to Gosatomnadzor of Russia are to be estimated from the point of their impact on the ship safety. They should be coordinated with Gosatomnadzor of Russia and inserted into SAR before start of operations affecting safety. Information presented in SAR should correspond to the current state of the depot ship.

1.2.4 Changes in the text of SAR should be done by the page replacement. While replacing separate pages it is necessary to indicate the ordinal number of edition and date of the replacement (month, year). The removed pages should be kept at the end of the corresponding sectors (chapters) of SAR.

The note on the ordinal number of edition, location and date of replacement should be put on the first page of the section (chapter) text. The register of changes is to be placed at the end of each section (chapter).

1.3. Requirements for the content and format of Safety Analysis Report

1.3.1 The content of SAR should correspond to the actual state of the ship and storage, systems (components) for SFA unloading. The meeting of this condition provides for the acceptability of information from SAR for Gosatomnadzor of Russia and the shortest terms for review of the licence application for the declared types of activities.

1.3.2 Requirements for the content of SAR.

1.3.2.1. The content of SAR should include as much information as possible to avoid additional review of the process, design and operational documentation. It is possible to refer to the design documentation, which is to be submitted upon the complementary request of Gosatomnadzor of Russia.

1.3.2.2. If information on safety justification is based on the more detailed studies or documents, SAR should refer to them.

1.3.2.3. The following information should be presented in each SAR section (chapter) representing an independent part of safety assessment:

- Data on a stage of work implementation, correspondence of the content of the section (chapter) to the actual state of the depot ship;
- Data on the materials foreseen in the original design and those which were actually used for the newly installed equipment and systems (components);

- An opinion (conclusion) of the Applicant on compliance of the design and technology with the RGs in the use of nuclear energy. If there are some deviations from them, the corrective measures are to be indicated.

1.3.2.4. It is necessary to present results of the computational analyses justifying their completeness and compliance with the current regulations (norms) and data on consideration of all the factors affecting the results. Data sufficient for fulfillment of the independent expert calculation, if necessary, are to be included into SAR (schemes, adopted assumptions, input data, output (results), their interpretation, conclusions).
All computer codes mentioned in SAR and evaluation of their applicability should be described in a scope sufficient for their understanding. The titles of the used computer codes and data on their certification are to be presented.

1.3.3 Requirements for the format of SAR are presented in Annex 1.

2. GENERAL DESCRIPTION OF THE LEPSE DS

Data on the Lepse DS briefly defining content of other sections of SAR should be presented in this section. A peculiarity of information presented in this section is a possibility of its use independently of other SAR sections. In particular, it may be used for informing of local authorities, public institutions and population on the concept and main technical solutions for safety ensuring of SFA unloading. This information should be presented in a form easy for understanding.

2.1. Technical parameters of the Lepse DS.

The following information should be presented in this sub-section:

- General information on the Operator and organizations implementing works and rendering services to the Operator;
- Results of calculations substantiating safety of works for the workers (personnel) of the DS, population and the environment and necessity of implementation of SFA unloading operations.

The following data should be presented as a general information on the ship:

- Information on the ship's class (category), a purpose of her use, main dimensions and an architecture-constructive type;
- Information on the ship's hull and its design, characteristics of the tank's vessels of the SFA storage and neutron fluence, ship's structures surrounding SFA storage facility and acting as a protective barrier, including data on their tests;
- Data on the ship's devices and systems ensuring DS safety; power supply; communication means; warning; system of automatic control of technical means; power supply diagram of the ship's system accepted for the period of SFA unloading; main, back-up and emergency power sources; their sufficiency for operation of the additional equipment; and brief description of the RM system.

2.2. The main results of the depot ship survey before start of the SFA unloading operations

The following information on the results of the ship's survey should be presented in this sub-section:

- Technical state of the systems and equipment used for the SFA unloading including ship's SIS and special systems;
- Radiological situation on board of the depot ship and on its site in accordance with the design collation map for all radiation factors considered by the unloading technology;
- Volumes and radiation characteristics of all RAW; data on the experimental and calculation studies of nucleonics and radiation characteristics of equipment, materials and additional systems (components) necessary for work implementation;
- Estimation of radiation characteristics and concentration of nuclear fuel spilled and suspended in the storage tanks;
- Availability (readiness) of all equipment used for SFA unloading;

- Practical training of the workers (personnel) of the DS in maintaining systems and equipment for SFA unloading;
- The estimated values of K_{eff} inside all premises of the SFA storage.

2.3. Concept of the safe unloading of SFA.

The concept of the safe unloading of SFA should be presented here including the following:

- Safety principles and criteria according to the Federal Rules and Regulations in the use of nuclear energy and IAEA recommendations;
- Brief description and substantiation of the SFA unloading option;
- Information on a place and duration of the interim storage of SFA (interim storage on-site, long-term disposal on-site or removal from the site) including their storage, loading and transport.

2.4. General description of the set of equipment used for SFA unloading.

It is necessary to give a general description of the set of equipment for SFA unloading and layout for its installation onboard. It is also necessary to present description of the schematic diagrams of SFA management in the process of this equipment use.

2.5. Assurance of the depot ship survivability.

Information on the results of examinations of the ship's systems being under supervision of the other regulatory bodies of the Russian Federation is to be presented here. Such examinations are carried out by these regulatory bodies with the purpose to inspect compliance of the ship's systems with the regulatory requirements for stability, unsinkability and fire protection during preparation for and implementation of the SFA unloading. The working stages where it is necessary to develop supplementary administrative and technical measures for ensuring of the ship survivability should be indicated.

2.6. Content of SAR for SFA unloading.

A content of the SAR sections should be briefly presented in this sub-section. Accepted criteria and principles for ensuring protection of the workers (crew), population and the environment are to be indicated.

3. NUCLEAR AND RADIATION SAFETY

A list of RDs in the use of nuclear energy taken into consideration for development of the SFA unloading technology is to be presented in this section. Compliance of the SFA unloading technology with the Federal Rules and Regulations in the use of nuclear energy should be confirmed here.

3.1. Main principles and criteria of safety ensuring during SFA unloading.

3.1.1. It is necessary to present safety criteria and principles for operations for the floating storage facility of the third class accepted in the SFA unloading technology and substantiation of these criteria and principles taking into consideration the following regulations:

- Safety Rules for storage and transfer of nuclear fuel at nuclear power engineering facilities (PNAE G-14-029-91);
- Radiation Safety Rules (Norms) 1999 (NRB-99);
- General Health (Sanitary) rules for radiation safety ensuring (OSPORB-99);
- General Provisions for safety ensuring of nuclear power installations of ships (NP-022-2000);
- Safety Rules for Management of RAW of ships and other floating means with nuclear reactors and radiation sources (RB-010-2000);
- Rules for design and operation of emergency alarm systems on initiation of self-sustaining chain reaction and arrangement of measures to mitigate its consequences (PBYa-06-10-91).

It is necessary to demonstrate implementation of a concept of safety ensuring of SFA handling during their unloading. It is also necessary to justify:

- Compliance with the principles of introduction of regulations, justification and optimization (NRB-99, Chapter 2) to ensure radiation protection of workers (personnel) and population;
- Compliance with a principle of separation of SFA by distances so as to avoid creation of the critical mass and design solutions to implement this principle in practice during operations including works done under conditions when tanks are being filled with water;
- Implementation of the defense-in-depth principle using a system of physical barriers at all stages of the SFA unloading process (casings, vessels of the SFA storage tanks, ship's structures and premises),
- Sufficiency of the system of technical and administrative measures stipulated for by the technology with a purpose to protect barriers and conserve their efficiency in work implementation and to minimize spreading of RS to out of the boundaries defined by the depot ship design;
- Implementation of ALARA principle in the work technology.

3.1.2. It is necessary to justify that the technology of work implementation considers criteria defined by the RDs in the use of nuclear energy listed above in 3.1.1 . It is necessary to demonstrate that:

- Impact on workers (personnel) of the DS and population will not exceed limits defined by NRB-99 and OSPORB-99 under normal technology of work implementation and under violations of technology;
- Expected individual effective doses of workers (personnel) of the DS and population in implementation of all types of activities will not exceed limits set up by the RDs in the use of nuclear energy; Collective doses will be minimized and amount of radioactive nuclides generated during work implementation will not exceed an annual limit of their intake to the environment due to releases and discharges;
- Selection of input data, methods, models for DSA and PSA and taken assumptions has been justified. It is also necessary to present an estimated annual effective dose at the boundaries of the controlled access area, observation area (DS site) and buffer area, as well as in places of location of the main radioactive sources on board;
- Selection of technical solutions and administrative decisions ensuring reduction of exposure to radiation up to the reasonably achieved minimum level has been justified during development of the unloading technology.

It is necessary to present the chosen criteria while justifying safety of activities, including those defining:

- Sub-criticality of SFA (PNAE G-14-029-91) at all stages of unloading process;
- Compliance of equipment designed for the SFA unloading and safety systems (components) with a principle of a single failure (NP-022-2000);
- An estimated probability of the maximum permissible release of RS does not exceed a value defined by NP-022-2000;
- Necessity (or absence of necessity) of installing of the emergency alarm system on initiation of self-sustaining chain reaction and justification of the actuation threshold according to PBYa-06-10-91.

3.1.3. Criteria on radiation safety.

It is necessary to present values of radiation safety criteria for work implementation. It is necessary to justify that selected technical means and administrative measures providing for protection of the personnel, population and environment from the unacceptable impact of radiation are sufficient. It is necessary to prove that use of the suggested means and implementation of measures is justified by practice, does not result in excess of the authorized dose limit and eliminate groundless exposure. It is also necessary to demonstrate that existing radioactive impact is as low as it is practically achieved taking into account economic and social factors. It is necessary to demonstrate effectiveness of the protective systems and their sufficiency to ensure negligible increase of risk for health or other risks for the workers (personnel) of the DS, population and the environment in comparison with the possible alternative productions.

It is necessary to present results of calculations made to justify strength and working ability of SFA unloading equipment and systems (components) of the ship and storage used for implementation of activities. It is also necessary to present results of calculations made to define capacities of mechanic, I&C and electric systems to fulfill their functions under combined impact of external events, emergency conditions or normal operation.

3.2. Nuclear safety ensuring.

3.2.1 Nuclear safety goals are to be formulated. Accepted criteria and technical systems and administrative measures providing for achievement of these goals should be presented including the following:

3.2.1.1 Ensuring of sub-criticality of tanks and caissons of the SFA storage;

It is necessary to demonstrate to what extent nuclear safety is ensured by separation of SFA and that changing in geometry of their location in the storage is impossible. It is also necessary to justify sub-criticality for all possible states of the storage during SFA unloading under emergencies and design basis accidents. Measures intended to avoid creation of the local critical masses are to be shown with estimation of their possible consequences.

3.2.2 Nuclear safety analysis should be done for conditions when K_{eff} has a maximum value.

It is necessary to consider a possibility of K_{eff} increase due to change of the fuel nuclide composition during its burning. The most severe cases should be described in section “Safety analysis for SFA unloading”.

Selection of the emergency alarm system on initiation of self-sustaining chain reaction and means for its prevention is to be justified (if it is necessary). It is also necessary to show why specific temperature control instrumentation and instrumentation for control of water existence inside caissons and tanks of the storage facility have been selected and to justify their sufficiency.

It is necessary to define types of fire extinguishers of fire-fighting systems, which do not result in changes of K_{eff} during fire extinguishing inside the SFA storage.

3.2.3 Prevention of the occurrence of local criticality in handling of the removed casings with SFA, transfer and interim storage of the filled inside covers and containers.

It is necessary to demonstrate that K_{eff} could not exceed the maximum value under any conditions at all stages of the SFA unloading process. The proposed measures to prevent local criticality during SFA displacement are to be justified.

3.2.4 The quick method of the conservative estimation of K_{eff} during SFA unloading from the storage is to be presented. It is also necessary to present information on the assumptions taken, accuracy of estimation, data on validation (certification) of the method, input data for calculations sufficient for the independent expert estimation.

3.3. Providing for heat removal inside the storage tanks.

It is necessary to justify:

- That cooling of casings with SFA is necessary (is not necessary) for all possible states of the storage during unloading process;
- Predicted operational modes of the cooling system to provide for the needed temperature in the storage tanks.

It is necessary to present a schematic diagram and description of the storage tank cooling system used during SFA unloading and under abnormal conditions.

3.4. Radiation safety ensuring.

3.4.1 Sources of ionizing radiation.

3.4.1.1 This section of SAR should present data on induced activity and surface contamination of equipment, which represents sources of ionizing radiation considered in estimation of the biological shielding efficiency, including data on:

1. SFA storage.
2. Equipment of the installation for SFA unloading, equipment for storage and transfer of SFA.
3. Systems (components) and hull structures of the ship that are radioactive.
4. Tanks and premises (enclosures), equipment and systems for collection, transfer and storage of RAW.
5. Other sources of radiation requiring radiation protection.

While describing sources of ionizing radiation it is necessary to present a table of radioactive nuclide's composition and emitted energy, data on activity and geometry parameters of a radiation source.

The following information is to be indicated on the drawings of general layout and schemes of the depot ship:

- Location of all radiation sources and possible and actual ways to transfer RS;
- Boundaries of the controlled access area and division of its compartments into inaccessible, periodically accessible and compartments of the observation area;
- Location of dose control posts, stationary and temporary personnel airlocks, special laundry and medical stations;
- Layout of routes of the DS personnel, delivery of clean equipment and removal of contaminated equipment, wastes and materials;
- Location of places for storage of contaminated equipment, decontamination zones, areas for RAW collection, control desks for equipment and mechanisms of RAW management systems;
- Location of detectors and control desks of radiation monitoring system;
- Location of laboratories for sample analysis of radioactive media, laboratories for individual dose control.

Sources of gaseous radioactive releases into atmosphere of premises within the controlled access area considered for development of protective means and estimation of occupational exposure doses are to be described.

Together with radiation sources already existing during SFA unloading operations radiation sources arising from the unloading process and failures of the main and supplementary equipment for SFA unloading and deviations from technology should be described.

The models, parameters and input data necessary for estimation of the predicted concentrations of radioactive gases and aerosols during implementation of work are to be presented.

It is necessary to indicate sources of RAW generation, their amount, activity and radionuclide composition being a basis for development of a scheme for management of all types of RAW accumulated during DS operation and generated during SFA unloading.

The mathematics models used for estimation management are to be described. Substantiation of the initial data (flow rates, concentrations, energy spectra, etc.) used for development of a technology for RAW is to be presented.

3.4.2 Biological shielding

3.4.2.1 An efficiency of biological shielding for each radiation source should be justified, including providing for information on properties of the shielding materials, thickness of coating, methods to determine properties of the shielding and geometrical parameters.

3.4.2.2 Equipment reducing needs for maintenance or a scope of other operations in radiation fields and reducing intensity of radioactive sources, ensuring remote control of operations or decrease of working time within the dangerous areas and other measures to decrease occupational exposure is to be described.

3.4.2.3 The results of calculations for estimation of dose rate inside free accessible and periodically accessible compartments of the controlled access area as well as inside compartments of the observation area are to be presented.

3.4.3 Technical means for air cleaning against RS.

3.4.3.1 It is necessary to present justification of sufficiency of ventilation systems of the controlled access area of the depot ship and the ship's ventilation and air cleaning system against gases and aerosols. It is necessary to indicate location of air cleaning devices, pipeline layout and location of system's components including process components on the scheme.

It is necessary to justify acceptability of maintenance conditions, and describe means of control, testing and isolation of system (components). Means and methods to define efficiency of air cleaning, replacement and transfer of the used filters (filtering elements) are to be grounded. Characteristics of the used air cleaning means and criteria for filter or filtering element replacement

are to be presented. It is necessary to present cleaning factors used for analyzing radiation hazard.

Estimations of the quantity of RS and dispersion composition of aerosols arising during operations done on the basis of the SFA unloading technology, structure of the DS compartments and data on specific equipment for the SFA unloading are to be presented here.

3.4.4 Technical means for radiation monitoring.

3.4.4.1 Criteria on selection of technical means for radiation monitoring are to be justified. Creation of a scheme of sampling points during SFA unloading is to be justified. It is necessary to describe the radiation monitoring means provided by the technology of SFA unloading, including instrumentation for:

- Permanent control on the basis of stationary automated systems and stationary devices (if they are);
- Ad hoc control on the basis of portable (mobile) and/or movable devices and installations;
- Laboratory analysis on the basis of laboratory devices, installations and means for sampling and preparation of radioactive samples for analyses;
- Individual control of occupational exposure.

3.4.4.2 It is necessary to demonstrate that hardware and methods of processing, analysis, displaying and transfer of information are sufficient to predict transport of radioactive substances and radiation conditions for all zones of radiation accident during a minimum time necessary for solving of this task. A scope and periodicity of control of radiation and meteorology parameters are to be indicated.

3.4.5 Structure of radiation safety units (departments).

3.4.5.1 Organizational charts of radiation protection units on board and on the site are to be presented. Professional skills and experience of the ship personnel should be presented with indication of authorities and responsibilities of workers for implementation of their functions.

3.4.5.2 Adequacy of technical and administrative measures to control occupancy of personnel within the controlled access area and following procedures for fulfillment of radiation-hazardous works is to be justified.

3.4.5.3 It is necessary to formulate tasks for units and services of radiation protection onboard and on-site directed to reduction of doses of the personnel and population exposure during operations or accidents, including:

- Radiation control on board and on the site, including integrity control and control of a state of protection barriers on the way of RS and ionizing radiation transport, occupational dose control, radioactive waste management control, control of discharges and releases of RAW. It is necessary to demonstrate that monitoring system can provide for measurement of dose rates and

contamination levels for gamma-, beta- and alpha- radiation and RS within all required ranges;

- Environmental radiation monitoring within buffer area and observation area of the depot ship including estimation of radiation exposure of critical groups of population and personnel, estimation of the tendencies and changes in accumulation of radioactive substances by the items of the environment and human body, correction of results of the environmental radiation monitoring by data on radiation control of discharges and releases of RS;
- Radiation monitoring in case of emergencies or accidents connected with RS releases to the environment;
- Radiation monitoring in the accident zone.

3.4.6 Protective means of workers (personnel) of the depot ship.

3.4.6.1 Location of the compartments served for medic and sanitary purposes is to be marked (medical stations, sanitary stations and special laundries). Types of equipment (devices, instruments) used for health (sanitary) control are to be justified.

3.4.6.2 Selection of individual protection means is to be substantiated. It is necessary to indicate their characteristics. It is necessary to describe instrumentation of exit dosimetry control stations, laboratory installations of radio- and spectrometry analysis, store places for the shielding clothes, means to protect breathing organs, equipment for decontamination of devices and materials and special treatment of the personnel.

4. SAFETY SYSTEMS (COMPONENTS)

In this section it is necessary to justify adequacy of the following for safety ensuring:

- Ship's SS and SS installed for the period of the SFA unloading, including design solutions implemented in the ship's systems and supplementary process equipment;
- Consideration and implementation of the main principles for design of such systems;
- Stability of SS against common course failures;
- Measures to ensure fulfillment by SS of its functions under external events and stability against human errors;
- Administrative and technical measures for SFA unloading.

4.1. Classification of Safety Systems (components).

4.1.1 A list of safety systems (components) is to be presented here with their classification according their purpose, effect on safety, nature of the implemented safety functions in compliance with the RDs in the use of nuclear energy.

4.1.2 It is necessary for each SS to justify its belonging to the appropriate class of SS, namely CTSS, PSS, CSS and SSS of the storage and process equipment with indication of their safety functions.

4.1.3 A list of systems for the routine use in the process, which may function as SS in emergencies, is to be presented together with analysis of such system's operation.

4.2. Description of safety systems (components).

4.2.1 This subsection should describe SS mentioned in para. 4.1.1 according to the recommended structure and content given in Annex 2.

4.2.2 This description should confirm that ship's and additional SSs meet requirements of safety regulations (PNAE G-14-029-91, NRB-99, NP-022-2000, OSPORB-99, PBYa-06-10-91).

4.2.3 If unloading technology anticipates the use of the ship's systems (components) that are not in a full compliance with requirements of RDs in the use of nuclear energy than all deviations should be mentioned in the description. It is necessary to prove that these systems (components) ensure limits for safe operation.

4.3. Results of the quantitative safety analysis

Both deterministic and probabilistic calculations are to be done for safety justification. Frequencies of the event and predicted consequences occurrence are taken into account while defining calculation methods on the basis of safety analysis results.

4.3.1. Data on justification of reliability of systems (components) of SIS are to be presented, including:

- List of reliability indicators for each type of equipment;
- Results of computational (experimental-computational) justification of reliability indicators;
- Conclusions on their compliance with requirements of the RDs in the use of nuclear energy;
- Results of the qualitative analysis of reliability;
- Estimation of uncertainties in the results of analysis;
- Estimation of possible effect of incompleteness of the factors considered in calculation;
- A list of components significant for system reliability;
- References to the used computational techniques and computer codes;
- Characteristics of the input data on reliability.

The results are expedient to be presented in a form of tables for each type of equipment.

4.3.2. Results of the implemented deterministic safety analysis given in detail in section 6 of this Guide are to be presented here in condensed form. Information on all groups of the considered emergency modes is to be presented including information on their number, justification of mode selection, purposes of analysis and characteristics of the results gained.

4.3.3. PSA results are to be presented, including:

- Characteristics of the initial database on reliability;
- A list of initiating events considered in analysis and its justification;
- Results of qualitative and quantitative analyses of system reliability and used fault trees and event trees, including data of the use success criteria;
- Consideration of common cause failures, human actions and errors and external events.

4.4. Control safety systems (components).

4.4.1 A list of CTSS is to be presented including alarm and communication implementing control functions for the following purposes:

- Providing for the SFA unloading process;
- More precise definition of operational limits and conditions as a basis for identification of the required systems (components) and their functioning for safety purpose;
- Elimination of deviations from the limits and conditions of the unloading technology;
- Accident prevention;
- Mitigation of accident consequences;
- Arrangement of management of the DS workers (personnel) and their notification under normal unloading and emergencies.

4.4.2 RDs in the use of nuclear energy, which requirements should be met by CTSS are to be listed.

4.4.3 It is necessary to describe a station for control of equipment for SFA unloading. It is necessary to justify technical solutions for:

- Registration of the DS worker (personnel) actions for management under emergencies;
- Automatic displaying of information on the state of safety important process equipment for the operator;
- In-service inspection of equipment important to safety conducted by an operator;
- Functions implemented automatically with displaying of information for the operator;
- A list of functions implemented by an operator and justification of duplication of the operations;
- Redundancy and manual control of the removal of equipment used in implementation of operations in the areas with increased ionizing radiation and radioactive contamination while an operator is inside the protective box.

4.4.4 It is necessary to list and justify controlled parameters of the SFA storage and SS, to show ways of control of parameters under normal operation and accidents.

4.4.5 The following should be considered in Safety Analysis:

- Effect of common cause failures excluding implementation of SS functions;
- Consideration of SS functions according to the approved list of IE for design and beyond the design basis accidents;
- Justification of CTSS compliance with safety requirements with regard to performance reliability, consequences of their failures, consequences of SSS (power supply, ventilation, etc.) failures.

4.5. Protective safety systems.

4.5.1 A list of PSS should be presented and justified. These systems are to be described according to Annex 2 and taking into consideration their features.

4.5.2 A quantitative analysis of PSS reliability is to be presented accounting for all types of failures. It is necessary to present results on analysis of failure effects on safety of the SFA storage and the DS. It is necessary to indicate failures with the most severe consequences requiring detailed consideration. It is necessary to demonstrate capabilities of PSS to manage beyond the design basis accidents.

4.5.3 Description of PSS performance under the design basis accidents and in case of failures should be presented.
It is necessary to show a possibility of the use of PSS for management of beyond the design basis accidents.

4.6. Confining safety systems.

4.6.1 It is necessary to present and justify a list of CSS and give their description according to Annex 2 and taking into account their features.

4.6.2 The following information is to be included into the description of the design data:

- The results of calculations confirming that CSS can sustain design basis accidents and external events without destruction and remaining in operation;
- Time from the beginning of the design basis accident or beyond the design basis accident till the moment when an accident confinement area will become accessible.

4.6.3 Qualitative and quantitative characteristics of failure consequences are to be presented in the failure analysis including factor of changing of the main parameters effecting safety of the ship. It is necessary to show effect of these failures on operability of other systems.

4.7. Support Safety Systems.

It is necessary to present and justify a list of SSS and give their description according to Annex 2 and taking into account their features.

4.8. Systems (components) used in SFA unloading operations and not affecting safety.

The following information should be presented while describing systems (components) used for SFA unloading and insignificant to safety: a list of these systems (components) and demonstration that they are not required for safety ensuring.

5. INSTALLATION FOR SFA UNLOADING AND UNLOAING TECHNOLOGY

A set of equipment used for SFA unloading is to be listed and justified in this section. It is necessary to show a list of completing articles, including spare parts and tools, metrology support and composition of a set of documentation ensuring safe SFA unloading from the point of view of reliability, maintainability and fire safety. It is also necessary to present information on the used basic and weld materials, electromagnetic compatibility and corrosion resistance.

It is necessary to confirm fitness of equipment and completing articles for storage, transfer and providing for control of the equipment in manufacture, testing and operation. It is necessary to demonstrate implementation of principles for safety ensuring in design, manufacture, testing, and operation and decommissioning of the equipment.

Diagrams of the use of equipment during SFA unloading operations are to be presented in this section. While developing these diagrams the dose burdens on workers (personnel) of the DS and effect of radiation factors on the environment are to be taken into account. It is necessary to ground measures for reduction of these doses and effects. It is also necessary to presents:

- A program of actions to put ship's SISs considered for their use by technology into the working condition;
- A program for preparation for mounting, mounting itself and preparation for performance of the supplementary equipment used for SFA unloading;
- Schematic process diagram for SFA unloading with indication of equipment used for unloading of casings with SFA, SFA located in caissons and casings with damaged SFA;
- Information on arrangement of accounting for, control and ensuring of physical protection of SFA and RAW.

5.1. Description of the composition of a set of equipment.

5.1.1 Components of the set of equipment for SFA unloading should be described in accordance with Annex 2 taking into consideration their features and with some additional information included into the following items of this Annex:

Item 2:

The results of factory and on site final acceptance tests of the productive prototype are to be presented.

Requirements for coupled systems (components) and their arrangement are to be justified.

Item 8:

Justification of equipment upgrade by the results of factory acceptance tests before installation of equipment onboard Lepse;

A program for commissioning of equipment after its installation onboard approved by OJSC "MSCo" should be presented. This program should

include tests in the "clean" area and pilot unloading of 2 to 3 SFA from the DS storage;
The training program for operators running equipment and results of this training are to be provided;
It is necessary to describe a state of SFA storage premises before putting up equipment into them.

5.2. A composition of a set of the operating documents.

Justification of adequacy (sufficiency) of the described set of operating documentation for the equipment is to be presented.

5.3. Description of SFA unloading operations.

5.3.1 A General description of the SFA unloading technology with justification of the following operations is to be presented:

- Installation of additional biological shielding and equipment for SFA unloading;
- Disconnection of a casings with SFA from the upper and bottom fixtures;
- Guidance of the transfer container and removal of a casing with SFA (SFA from a caisson);
- Transfer of a casing with SFA (SFA) and placing into the cover;
- Drying of casings with SFA (SFA);
- Sealing of the cover with casings (SFA) inside a transfer container, its transfer and reloading to the cost means.

5.3.2 Justification of the design conditions, limits and tolerances for the safe implementation of operations is to be provided in the description of technology for these operations, including:

- Justification of the protective properties of shielding of the room of an operator implementing remote control of the equipment, insulation of the storage deck;
- Justification of adequacy of measures for elimination of drops of casings with SFA during their handling;
- Justification of a possibility for the remote monitoring and control of all process operations; brief description and justification of safety measures at each stage of SFA unloading;
- Criteria on reaching of the required safety status upon completion works for each stage of SFA unloading.

6. SAFETY ANALYSIS OF SFA UNLOADING

Response analysis of the DS systems (components), SFA storage and unloading equipment to possible initiating events should be included into safety assessment of SFA unloading of the ship's store. The purpose of this analysis is to define sequences of events (scenarios) and conditions of their progression taking into consideration dependent and independent failures and damages (faults) of systems (components), common cause failures, human errors and unauthorized actions of personnel.

Scenarios of predicted events and their consequences should be presented in this section. It is also necessary to present an estimated possibility of intervention in system's (component's) operation with a purpose to control process's progression. While conducting analysis any predicted IE is imposed by the failures mentioned above and undetected failures.

6.1. A list of Initiating Events of violations in technology of SFA unloading.

6.1.1. Classification of IE.

A recommended list of IE is given in Annex 3. An Applicant should modify this list taking into consideration factors of external effects considered by safety justification of activities at facilities of GURTP "Atomflot" and MSCo or to add it with IE resulting in severe consequences according to the results of SIS analysis.

Lists of IE for design and beyond the design basis accidents should be formed from the common list for the purpose of safety analysis.

Each IE is to be considered in combination with different failures with a purpose to select for analysis scenarios with the most severe consequences.

Initiation events should be classified as "Internal" and "External" according to their impact on the facility (SFA storage and DS).

6.1.1.1. Causes of IE and identification of IE.

Specific IE should be defined in each class of IE. A cause of their occurrence should be considered. Independent expert assessments of the qualitative changes in the facility parameters occurred under the analyzed IE are to be presented for those parameters which are used for identification of IE. If IE does not lead to the dangerous consequences according to the independent expert assessments, then it is sufficient just to present a qualitative description of its consequences.

Wider information should be presented for those IE that result in severe consequences.

6.1.1.2. Analysis of the possible ways for emergency progression (scenarios) associated with IE and preparation of a list of accidents considered by the SFA unloading technology.

The following information should be presented for each IE:

- Boundaries of start and stop in SS performance;
- Sequence of actuation of systems (components), production of signals, actuation of settings for warning and maximum permissible values of parameters, required actions of personnel;
- Impact of systems (components) used during normal operation on the process progression;
- Estimation of a scope of information on the situation progression that is necessary for personnel.

It is necessary to make qualitative estimates of IE consequences for superposition of the above mentioned failures. Sequences (chains) of events and failures that may result in the most severe consequences are to be selected on the basis of these assessments of IE.

Preliminary independent review of possible accident sequences is an obligatory element of analysis. A list of accidents considered by the SFA unloading technology and being a subject of further quantitative analysis is developed on the basis of this analysis according to the criterion on more severe consequences but without exceeding of dose limits and authorized releases of RS.

6.1.2. List of beyond the design basis accidents.

6.1.2.1. Scenarios of beyond the design basis accidents resulting in the heightened releases of RS to the environment. Vulnerable operations of the unloading technology.

Scenarios of beyond the design basis accidents resulting to exceeding of exposure doses for personnel and population and authorized limits for releases and content of RS in the environment stipulated for accidents considered by the SFA unloading technology should be selected on the basis of analysis results. Vulnerable operations of the SFA unloading are defined through the minimal cross-sections of the event trees.

6.1.2.2. Typical groups of scenarios for beyond the design basis accidents.
Groups where a response of the systems (components) required for prevention of an accident progression is the same are formed from scenarios selected in analysis.

6.1.2.3. Representative scenarios of beyond the design basis accidents.
One or a number of representative scenarios complying with criteria listed below should be selected from each group of scenarios from item 6.1.2.2. These criteria are the following:

- Maximum dose rates for personnel and (or) population;
- Maximum intensity of RS release;
- Maximum total release;
- Maximum extend of damages of facility systems (components).

6.1.2.4. Scenarios selected in item 6.1.2.3 should be represented in a list of beyond the design basis accidents for their further analysis.

6.1.3. Analysis of processes in case of violations in the unloading technology.

Data on analysis are appropriate to be presented for each IE according to a sequence given in Annex 4.

6.1.4. Conclusions.

It is necessary to present results of analysis and to make conclusion on compliance (incompliance) of the SFA unloading technology with requirements of RDs in the use of nuclear energy.

6.2. Analysis of accidents considered by the SFA unloading technology.

6.2.1. A list of IE for accidents considered by the SFA unloading technology.

A list of IE for accidents considered by the SFA unloading technology and mentioned in para. 6.1.1.2 considered in safety analysis.

6.2.2. Safety analysis.

Description of performance of systems (components) in case of an accident is to be presented. The results of analysis for each accident considered by the SFA unloading technology should be presented according to the recommended sequence given in Annex 4.

6.2.3. Conclusions.

It is necessary to present results of analysis of the accidents considered by the SFA unloading technology and to describe their consequences. Conclusion on safety ensuring of the SFA unloading in case of occurrence of these accidents is to be done on the basis of information on radiation consequences of an accident and estimation of sub-criticality.

6.3. Analysis of beyond the design basis accidents.

6.3.1. A list of beyond the design basis accidents and its justification.

6.3.1.1. Groups of beyond the design basis accidents.

Accidents which may result in overdosing of the DS workers (personnel), creation of the local critical mass or maximum permissible release of RS to the environment are to be included into a list of beyond the design basis accidents. Selected accidents should be divided into the following groups:

- Accidents caused by change of reactivity, including accidents:

a) due to change in geometry of nuclear fuel location;
b) due to change in composition of the medium in the storage tank;
c) due to leakage of radioactive media (air, water) from the systems (components) which are used according to the SFA unloading technology;

d) due to by mechanical damages of casings with SFA (SFA) during their transfer to outside storage tanks (caissons) according to the technology.

Accidents selected for analysis should suffer a potential risk of SFA damages or dangerous releases of RS to outside sealing devices (casings, covers, containers, tanks and premises of the storage and the ship).

A list of beyond the design basis should be justified by PSA results.

Compliance (non-compliance) with technology criteria is to be confirmed in the process of accident analysis.

6.3.1.2. A list of beyond the design basis accidents should be prepared taking into consideration items 6.1.2.1 – 6.1.2.3 and the results of analysis of the design basis accidents.

6.3.2. Sequence of analysis of beyond the design basis accidents.
The recommended order of analysis of beyond the design basis accidents is given in Annex 5.

6.3.3. Estimation of probabilities for SFA damages and releases of RS on the results of analysis of beyond the design basis accidents.
It is necessary to estimate a probability of the SFA damages and releases of RS; describe the results obtained and make preliminary conclusions on the possible ways for prevention of inadmissible damages of SFA and releases of RS.

6.3.4. Conclusions.
The results of analysis of beyond the design basis accidents are to be presented. Conclusions on compliance of process operations with requirements of the RDs in the use of nuclear energy are to be made.

7. LIMITS AND CONDITIONS FOR SAFE SFA UNLOADING, OPERATIONAL LIMITS OF SYSTEMS (COMPONENTS) OF THE SFA STORAGE

Information on limits and conditions for safe SFA unloading, operation and operational limits of SS of the SFA storage and the DS defined by the unloading technology is to be presented in this section.

Operational limits, limits and conditions for safe operation are to be based on safety analysis of the ship's systems (components), SFA storage and equipment according to statements from their descriptions and design documentation.

7.1. Limits of safe operation.

7.1.1. Settings for SS actuation.

Settings for SS actuation should be given in this sub-section. It is necessary to justify stated values of settings and indicate modes where these settings may be reached. It is also necessary to present information on accuracy and principle for forming of the SS actuation command. It is necessary to give values of settings for actuation of the warning and alarm systems with justification of an interval between settings for the SS actuation.

7.1.2. A list of the controlled parameters and limits of safe operation of systems (components) important to safety.

All controlled parameters are to be listed. It is necessary to justify the stated values and methods for their measuring, permissible duration of loss of information, redundancy of the measuring channels.

It is necessary to specify limits for the controlled parameters. Deviation from these limits is considered as a violation of limits of safe operation and results in an incident in the SFA unloading process or an accident.

7.2. Operational limits.

7.2.1. Modes of operation of systems (components) defined by the technology.

Selected values of the process parameters are to be justified together with providing with information on accuracy of their measurements, places of measuring and redundancy of the measuring channels, permissible time of loss of information.

7.2.2. Process protections, interlocks and automatic regulators with settings for their actuation.

Values of the process parameters used as settings for actuation of the process protections, interlocks and automatic regulators of the SFA unloading systems (components) are to be presented. The stated values of the process parameters are to be justified for modes defined by the SFA unloading technology. It is necessary to provide

with justification of the selected parameters and information similar to those described in para. 7.1.2.

7.3. Conditions of safe operation of systems (components).

7.3.1. The operational modes of systems (components) defined by the technology.

The operational modes of systems (components) defined by the technology are to be presented. It is necessary to give definitions for the mentioned modes and specify their operational limits for parameters. The specified limits are to be expressed through values of parameters controlled by an operator, or have to demonstrate relation of the limiting parameter with the controlled one.
Limitations imposed to the permissible parameters and operational modes defined by the SFA unloading technology are to be justified.

7.3.2. Conditions of the safe operation and a composition of operable systems (components) needed for SFA unloading under modes specified by the technology.
Information on a composition and status of systems (components), which operability or readiness status is required for implementation of the unloading operations under the modes defined by the technology is to be presented.
It is necessary to state requirements for SS. A composition and a set of equipment which operability is necessary for implementation of operations are to be specified for each system.

7.3.3. Permissible deviations from the process parameters and permissible time of performance of systems (components) under these deviations.
Information on permissible time of operation of systems (components) under deviations from the process parameters and information on values of deviations from the values defined as conditions of the safe operation is to be presented.
It is necessary to specify a way to transfer systems (components) to the state required by the SFA unloading technology. It is necessary to justify selected conditions.

7.3.4. Recommendations for estimation of duration of system (component) operation beyond the design limits, under emergency conditions from the point of view of safety of SFA unloading should be given.

7.3.5. Conditions for implementation of examinations, maintenance, testing and repairs of SS.
Conditions for implementation of tests, examinations, maintenance and repair of SS are to be specified.

7.4. Administrative conditions and recording of data on control of limits and conditions for safe operation of systems (components). Control of observance of operational limits and conditions.

7.4.1. Requirements for Management of the Operator and workers (personnel) of the DS with regard to compliance with the prescribed

limits and conditions of safe operation are to be presented. It is necessary to give a list of the standard documentation and describe procedures used for registration and recording of all deviations from limits and conditions of safe operation of systems (equipment) and for control of their elimination.

7.4.2. Control of compliance with limits and conditions for safe operation of systems (components) is to be stipulated for. It is necessary to define its periodicity and a scope and record results on this control.

8. TRAINING OF PERSONNEL OF THE DS, OPERATION AND MAINTENANCE OF SYSTEMS (COMPONENTS)

Justification of necessary changes in the managing structure of the Operator in connection with implementation of the SFA unloading, training of personnel and maintaining of operability of systems (components) of the ship, storage facility and a set of equipment for SFA unloading is to be presented in this section.

8.1. Changes in the organizational chart.

It is necessary to present justification of:

- The optimal changes in the production structure of the Operator with indication of functions of the structural units established for work fulfillment at all stages of preparation for and implementation of SFA unloading;
- Changes in the organizational structure of management of the Operator with indication of the structural units, authorities of leaders and their responsibilities for nuclear and radiation safety ensuring during works, including technical staff minding the ship, storage and equipment; number of staff (considering redundancy) and a list of job descriptions;
- Changes of the ship's organizational structure for nuclear and radiation safety ensuring during SFA unloading.

8.2. Selection and training of workers (personnel) of the DS.

Justification of principles for staffing, initial training, certification and periodical examinations and training is to be presented, including:

Managers of the Operator, workers (personnel) of the DS running equipment for SFA unloading, organizations implementing works and rendering services affecting nuclear and radiation safety during SFA unloading;

System for control of updating of the required professional skills of the DS workers (personnel), including their training at simulators to train actions under normal conditions of implementation of the process operations, violations of the working technology and accidents considered by the unloading technology;

System for selection, training, acceptance and refreshment training of the staff;

Analysis of adequacy of the training means and simulators for maintaining professional skills of the DS workers (personnel);

Conducting briefings with the DS workers (personnel) stipulated by the safety precautions;

Training of the DS workers (personnel) to fight for survivability of the ship, including training in fighting against nuclear and radiation accidents.

8.3. Maintenance of systems (components)

Justification of maintenance of systems (components) of the ship and equipment for SFA unloading and for safety ensuring is to be presented, including:

- Presentation of requirements for maintenance of SS, SFA storage and safety precautions to be met by workers (personnel) of the DS;
- Definition of frequency and scope of maintenance of systems (components) and equipment for SFA unloading according to the operational manuals;
- Justification of schedules for maintenance and repair of systems (components) and equipment for SFA unloading;
- Definition of dates and scope of the author's supervision of operation of equipment from the side of the Designers;
- Justification of dates and scope of maintenance of equipment and systems providing for physical protection of SFA and RAW;
- Definition of measures for implementation of the optimum supervision of safety ensuring in implementation of activities and keeping of the operational documentation;
- Defining of features relevant to maintaining of the technical readiness of safety systems (components) in the long-term storage and mothballing.

8.4. Observation in the period of inactivity. Ad hoc documenting.

The following is to be justified:

- Arrangements for shift and duty services, observation of the SFA storage and equipment in the period of inactivity;
- A procedure for keeping ad hoc documenting of work implementation, radiation situation, occupational doses and evens relevant to implementation of the process operations for SFA unloading; procedure for storage and presenting of information;
- A list of potential nuclear-hazardous activities and technical requirements for their implementation;
- Procedure for classification and investigation of violations in the technology and presentation of information on the violations.

9. QUALITY ASSURANCE

Information on quality assurance of all implemented works and rendered services to the MSCo which affect safety of implementation of the SFA unloading operations onboard Lepse which is to be submitted by MSCo as a part of SAR is to be presented in this section.

Information provided by the Operator in SAR should justify that design, manufacture, testing, operation and decommissioning of additional equipment used for SFA unloading, preparation of the ship's systems and unloading technology are carried out properly and comply with requirements of "Quality Assurance Program of activities for unloading of SFA in implementation of the industrial Lepse project".

On the stage of obtaining a licence for implementation of SFA unloading operations MSCo should present as a part of SAR information on areas of activities for quality assurance with a purpose to estimate sufficiency of quality assurance activities.

10. ARRANGEMENT OF ACTIVITIES FOR SFA UNLOADING FROM THE DS STORAGE. EMERGENCY PREPARADNESS

Information on preparation and arrangement of works for SFA unloading from the DS storage is to be presented in this section. This information should provide for a confidence that organizational structure (chart) of the Operator and a set of administrative and technical measures stipulated by him ensure compliance with the licence conditions for implementation of the works.

10.1. Organizational chart of the Operator.

10.1.1. Organizational chart of that part of the Operator should be presented which activity is aimed to implementation of the declared activities for the SFA unloading. A list of structural units or organizations engaged by the Operator to carry out specific activities is to be presented indicating names of organizations, managerial posts, structure of the units, personnel duties of the DS workers (personnel). Information on individual practical skills of the permanent and engaged personnel gained on the working places, their professional skills and responsibilities is to be presented. Data on shearing responsibilities and authorities between units are also to be presented.

10.1.2. Information on the accepted system for control of the progress in SFA unloading, procedures for gathering and analyzing data and information on the current safety status of SFA storage should be provided in this section. Information on implementation of quality assurance programs should be presented here.

10.2. Physical protection system.

10.2.1. The main engineering and administrative measures serving to prevent unauthorized actions of the DS personnel or other persons with regard to nuclear materials, RS, RAW or systems (components) of the depot ship are to be presented. Unauthorized actions are those actions that can directly or indirectly cause emergencies and create danger to health and safety of the DS personnel and population. Information presented in this section should be confirmed by compliance with requirements of the RDs in the use of nuclear energy.

10.2.2. The main schematic diagrams of engineering means of the physical protection system are to be provided. Moreover it is necessary to present a schematic structural design of the physical protection system used to ensure the depot ship security. Location of control stations, alarm and observation stations is not to be indicated. A sub-section devoted to the physical protection system should have a confidentiality status and label.

10.3. Emergency measures.

10.3.1. Information the planned and implemented in practice measures to protect population including development (necessary correction) of a

plan of measures for protection of personnel and population against radiation consequences of accidents occurred during SFA unloading is to be presented.

10.3.2. Information on stations for controlling of emergency response actions on board Lepse should be presented. Control stations are located on the site and also in such a place where they would not be affected by an accident simultaneously with the main control center.

10.4.3. Possible consequences of accidents and appropriate measures for their full elimination or mitigation should be presented. It is necessary to indicate what criteria are used to transfer from accident management to consequence mitigation.

Programs and schedules of training and emergency exercises are to be presented with indication of categories of administrative and operational staff participating in training for implementation of the appropriate actions in case of emergencies and during mitigation period. Technical means used for training are to be described together with time limits for implementation of different actions.

10.4. Management of emergency measures.

10.4.1. Information the planned and implemented in practice measures to protect the DS personnel and population in case of accident is to be provided in compliance with requirements of the RDs in the use of nuclear energy. The following issues should be taken into consideration:

- Levels of emergency preparedness and response;
- Administrative measures in case of emergency including:
  - Allocation of responsibilities and revision (development) of plans for coordination of actions with external organizations within the DS site and buffer area;
  - Correction of a list of officials responsible for emergency notification and announcing initialization of “Plan for the DS personnel and population protection against radiation consequences in case of nuclear and/or radiation accidents on the Lepse DS” ;
  - Instruction on communication means to be used for notification and conditions of notification.

10.4.2. The following is to be indicated:

- Types of emergencies that should be included into emergency response plans, methods of the DS personnel and population notification; Types and amounts of RS, which can be released to the DS compartments, ways of radiation impact and necessary protective means;
- Emergency procedures, sequence of measures and time necessary for their implementation; Number of the DS personnel and engineering means needed to estimate a situation, implement corrective actions, protective measures,

arrange communications and keep reporting documentation as well to provide first aid to victims;

- Criteria to initiate an evacuation of the DS personnel, providing for the first aid and estimation of the necessary medicines;
- Availability of protected stations for management of the emergency response measures on the DS site;
- Availability of shelters;
- Status of construction of buildings on the DS site and close by for the initial sheltering of the DS personnel;
- Correction (if necessary) of planning of measures to prepare the basic and back up regions for receiving of the evacuated DS personnel in case of accident onboard Lepse.

ANNEX 1. REQUIREMENTS FOR THE FORMAT OF SAR

1. SAR is completed in the loose-leaf binders according to the independent sections (chapters) or sections and sub-sectors, if necessary. Design of SAR sections should be common for all states of the DS.

2. The list of abbreviations used in the text should be placed at the beginning of each section (chapter).

   Name of the ship, the full title of the Report and corresponding section (sub-section) should be indicated on each binder.

3. The Report should be designed according to GOST R-630-97 “The unified system of the organizational-managing documents. Requirements for the design of documents”. Thus:
   - The graphic data presented in SAR should be produced in a scale suitable for reading;
   - The pages are to be separately numbered for each sections (chapters), representing independent parts. The page number should consist of a number of section (chapter) and a number of the page itself.

ANNEX 2. RECOMMENDED STANDARD DESCRIPTION OF SAFETY SYSTEMS (COMPONENTS) AND SYSTEMS IMPORTANT FOR SAFETY DURING SFA UNLOADING OPERATIONS

1. Structure and content of system (component) description.

Information on systems (components) important to safety and defined in para. 4.2.1 of this Guide should be presented according to a structure given below.

Information on system (component) description should demonstrate that a system (component) (design of system, component) meets requirements of RDs in the use of nuclear energy.

2. Purpose and design fundamentals

It is necessary to present information on applicability of the system (component), to indicate its place according to safety classification, applicable criteria and principles. Also it is necessary to describe design limits used as a basis for the system (component) design for its further operation according to the SFA unloading technology and under events and accidents envisaged in the technology. Safety functions of the system (component) are to be defined. Success criteria for implementation of the system (component) functions are to be indicated.

Maximum permissible values of operational parameters are to be defined. It is necessary to present information on permissible values of reliability parameters in functioning of the system (component) to ensure safety.

3. Description of design and/or process flow diagram.

Design and/or process flow diagram should be described with indication of individual sub-systems (components) implementing independent functions, including fixtures, supports and foundations.

Values of reliability factors are to be given if they are stipulated in the RDs in the use of nuclear energy.

Drawings and diagrams illustrating design or a schematic diagram of the system (component) are to be provided together with the main technical parameters of the system (component).

Other systems (components) important to safety of the SFA storage and the ship’s systems (components) relevant to operation of the system (component) are to be defined.

4. System control.

Principles for control of the safety system (component) are to be described. Parameters (settings) for actuation of protections and interlocks are to be presented. Requirements for the accuracy of the measured parameters and for metrology support of instrumentation and techniques for measuring of these parameters are to be described.

Control circuits of the system (component) are to be analyzed to study possible dangerous responses of the system (component) resulting in deviations from the limits of safe operation caused by circuit faults (short current, insulation deterioration, frequency and voltage fluctuations in the power supply circuits).

5. Materials.

Selection of materials should be justified. Implementation of operations under normal process conditions, events and accidents envisaged in the SFA unloading technology is to be taken into account.

6. Quality assurance in manufacture, tests and mounting.

The main requirements for quality assurance in manufacture, mounting, bench and site (onboard) tests are to be indicated for all systems (components).

7. Commissioning.

Information on commissioning activities for the system (component) should be presented including a list of test programs. It is necessary to indicate activities dangerous from safety point of view and measures preventing accident appearance. It is necessary to demonstrate that a scope of tests for the system (component) is sufficient to justify safe unloading of SFA.

8. Examinations and tests in implementation of the SFA unloading operations.

Information on methods, means, scope and terms of examinations of status and tests of the system (component) to ensure its operational reliability in work implementation is to be presented.

It is necessary to indicate measures stipulated for these purposes by the unloading technology and to demonstrate their compliance with requirements of RDs in the use of nuclear energy.

9. Normal operation of the system (component).

Operation of the system (component) in activities implemented according to the SFA unloading technology including all process stages and interruptions in works is to be described. It is necessary to describe status of the system (component) and its interaction with other systems (components) of the storage and the DS in the process of its performance of safety functions.

Requirements for protection of the DS workers (personnel), SSs and SFA storage during their maintenance are to be given.

Performance of the system (component) considering loads connected with failures of other safety important systems of the SFA storage and the ship is to be described. It is necessary to describe characteristics of the system (component), measures provided by the design and used for protection of the system (component) against impact of these failures.

10. Performance of the system (component) in case of failures.

Analysis of the single failures of the system (component) including human errors should be carried out. It is necessary to give an estimation of their frequency, their consequence impact on operability of the system (component) and safety of the SFA storage.

Failures of the passive components, instrumentation and control system (component) and control and support systems (components) relative to it are to be considered to define requirements for these systems (components). A special attention should be drawn to analysis of the common cause failures including possible fires, flooding by outboard water and loss of power.

While considering failures it is necessary to present safety requirements for SS and SFA storage. Qualitative and quantitative (if necessary) characteristics of consequences including those affecting safety of the SFA storage are to be presented for failures under consideration. It is necessary to show effect of these failures on operability of other systems of the SFA storage.

A set of safety systems (component) necessary for confinement and/or mitigation of consequences of such failures is to be defined. It is also necessary to formulate requirements for these systems (components).

Impact of failures of the individual components on operability of the system as a whole is to be analyzed for safety systems (components).

As a result of this analysis it is necessary to select failures, which are IE for violations of the SFA unloading technology and beyond the design basis accidents and require additional in-depth analysis to be presented in section “Safety analysis for unloading”.

The following conditions are a basis for selection process:

e) Consequences of the IE are those that RS are released beyond the bounds stipulated by the technology in amounts exceeding prescribed values for the normal unloading of SFA;

f) Consequences of the IE do not seem obvious from materials presented in this section and require supplementary in-depth analysis for justification of compliance with safety criteria and limits defined by the design.

11. Reliability analysis of the system (component).

Quantitative analysis of reliability of the system (component) is to be carried out on the basis of data from para.10 and according to the requirements of RDs in the use of nuclear energy.

12. Safety assessment of design of the system (component).

On the basis of the implemented review and taking into consideration the results of analysis of section “Safety analysis of the SFA unloading” it is necessary to demonstrate compliance of the system (system design) (component) with the stated safety criteria and principles, and limits defined

by RDs in the use of nuclear energy and laid to the technology of the SFA unloading operations.

ANNEX 3. RECOMMENDED MINIMUM LIST OF INITIATING EVENTS

1. Internal initiating events.

1.1. Changing in geometry of nuclear fuel location inside a storage tank caused by the impact on casings with SFA (damage of a casing during its removal and spilling of nuclear fuel, drops of casings) during their disconnection from fixtures and further removal from the storage.
1.2. Origination of self-sustaining chain nuclear reaction in the SFA storage.
1.3. Filling of storage tank (caisson) with water.
1.4. Sticking of a casing in the top plate.
1.5. Loss of the DS power supply during process of SFA unloading.
1.6. Failures in the transfer-and-handling operations with SFA (drop of a container with SFA from the maximum possible process height).
1.7. Fire inside the SFA storage.
1.8. Fault actuation of systems or equipment.
1.9. Others.

2. External initiating events.

2.1. Shock caused by aircraft crash, drop of a load from a crane or a moving ship.
2.2. Earthquakes.
2.3. Electro-Magnetic Interference.
2.4. Extreme weather conditions, including wind, precipitation, temperature, ebbs and flows.
2.5. Fire in the vicinity of the ship.
2.6. Explosion or Blast (Internal & External).
2.7. Missiles.
2.8. Drop of the process container with a cover overboard.
2.9. Capsizing of the DS.
2.10. Sinking (flooding) of the depot ship in shallow water near the pier.
2.11. Others.

A list of IE can be changed considering the operation modes of safety important systems (components) leading to the severe consequences and revealed in the analysis of these systems (components).

ANNEX 4. RECOMMENDED SEQUENCE OF PROCESS ANALYSIS IN CASE OF VIOLATIONS IN SFA UNLOADING TECHNOLOGY AND ACCIDENTS CONSIDERED BY THE SFA UNLOADING TECHNOLOGY

1. Initial status of the ship, storage, equipment and her systems (components) before origination of the IE.

   Status of systems (components) of the DS and storage facility for the moment of violation of the unloading technology is to be described for an IE. Degree of details in the IE description should depend on the nature of violation and is to be sufficient for safety analysis. A status of the storage facility, stage of work implementation, parameters used for calculation of the status are to be presented.

   If analysis is done for the violations, description of other complicating circumstances should be presented.

   The Developer of SAR should define a degree of details in description of an initial status for each IE.

2. Performance of systems (components).

   Performance of all systems (components) ensuring SFA unloading without violations should be described. It is necessary to describe the violation, indicate parameters defined by the SS properties and needed for analysis.

3. Consideration of the possible failures of systems (components).

   While describing the prescribed performance of SS the possible failures should be taken into account. Failures resulting in the most severe consequences are to be considered.

4. Analysis technique.

   The math models and computer codes used in emergency analysis for violations should be described. For the certified computer codes description clarifying the main point of the used models and assumptions should be presented with a reference to the certification documents. For computer codes which have not been certified the planned dates of certification are to be indicated in the description. Data on the math models, assumptions and their verification are to be presented.

5. Input data for analysis.

   Initial data required for incident & accident analysis on board the DS (design features of systems, parameters characterizing mode of their performance, neutronic properties of spent nuclear fuel, mechanical properties of metals, etc.) are to be described. A full set of input data should be defined taking into account performance of the ship’s systems

(components) and additional equipment which status is changed depending on the violations. If input data are given in other sections of SAR it is necessary to refer to the those sections. If the required data are not presented in SAR it is necessary to present them in section 6 of this Guide.

6. Results of analysis.

The objective of analysis is to justify technological requirements for SS characteristics, confirm compliance of working process with safety criteria and requirements. Circuits of the generated control signals, settings of devices warning on the deviations of parameters, acceptable delays in the signal forming for the used CTSS are to be justified. The obtained characteristics should be analyzed taking into account performance of SS for the normal operation.

Analysis of violations in case of loss of power supply will allow justification of a set and necessary redundancy of power sources.

Analysis of the pre-accident conditions should demonstrate effectiveness of SS prescribed by the technology and possibilities to prevent transit of the pre-accident situation to the accident.

7. Assessment criteria.

Performance within the limits of safe operation is the main criterion of SS effectiveness in case of the considered violations.

The following should be considered in assessment of failures:

g) A number of the process modes, which result in the given incident (frequency of occurrence);
h) Damages (destruction) of SFA, hull structures and technical means of the DS, release of RS caused by thermal, mechanic and radiation impacts;
i) Physical-chemical interactions of materials of the SFA storage;
j) Effect of the fission products and impurities on corrosion of the SFA casings;
k) Impact of radiation factors degrading mechanical properties of the DS and storage structures and integrity of casings and SFA.

While assessing consequences of the IE it is necessary to specify their impact on the DS workers (personnel) and environment, estimate status of SFA and the DS as well a predicted radiation situation and damages of the ship’s structures and technical means.

It is necessary to demonstrate that systems (components) of the ship and equipment are reliable during the whole unloading process taking into consideration chemical-corrosion, radiation, temperature, mechanical and other impacts possible in the process operations and incidents. The

mentioned criteria are the basis for assessment of the pre-accident conditions.

ANNEX 5. RECOMMENDED SEQUENCE OF ANALYSIS OF BEYOND THE DESIGN BASIS ACCIDENTS

1. Initial status of the DS before an accident.

   Requirements for description of the initial status of the DS before beyond the design basis accident initiation are similar to those for description of the initial status of the DS before an accident considered by the unloading technology.

2. Analysis technique.

   Requirements for analysis technique are the same as mentioned in item 4 of Annex 4.

3. Input data for analysis.

   Parameters of systems (components) of the DS, which allow modeling of processes in the SFA storage, are to be provided. The DS site and a region of its location should be described. It is necessary to present hydrology and meteorology data, demography data needed for estimation of the RS transport in the region and effective dose equivalents for the DS personnel and population.

4. Results of analysis of beyond the design basis accidents.

   The results of analysis of accident processes in the DS storage facility are to be described according to the scenario of beyond the design basis accidents. Data on spatial-time distribution of parameters of the accident processes are to be presented. It is necessary to present data on time reserve before transition of the accident processes to the critical phase corresponding to the specific level of damages of the storage facility and RS releases outside storage premises and the ship. Estimation of this release is to be the final stage of the analysis of beyond the design basis accident.

   Results of estimation of RS release outside the SFA storage facility are to be used in estimation of the RS transport in the DS premises and environment. Transport of gaseous, volatile RS and radioactive aerosols and their deposition on the surfaces of premises and CSS filters are to be taken into account. The worst possible data on integrity of the DS premises and meteorological data are to be used for estimation. It is necessary to consider all possible pathways for the population exposure. Conclusions on compliance with requirements of NRB-99 and on the need to take protective measures including evacuation of the population are to be done on the results of estimation of effective doses and dose equivalents for the DS personnel and population within one year after the accident.

5. Measures for management of beyond the design basis accidents in particular should include the following:
    - Definition of the ad hot safety objectives. There are those objectives which the DS personnel should try to achieve for prevention or cessation of propagation of damages of systems (components) and/or SIS or for limitation of RS releases to the environment for each severity level of beyond the design basis accident;
    - Description of indicators of the DS state and setting up of criteria on the basis of the fulfilled analyses of beyond the design basis accidents. These criteria together with state indicators may be used to identify the fact of occurrence of beyond the design basis accident and to follow its progression according to severity levels;
    - Identification of all systems (components) of the DS including those which do not belong to SIS that may be used for achievement of the ad hot safety objectives and limitation of accident consequences at each level of its progression. Stand-by systems are to be analyzed;
    - Formulation of success criteria for actions of the DS personnel aimed to achieve ad hot safety objectives at each level of accident severity and their definition through indicators of the DS state;
    - Indication of information required for definition of indicators of the DS state and levels of accident severity. Information needed for control of systems (components) and estimation of success in actions for management of beyond the design basis accident is also to be provided. It is necessary to describe methods, which allow obtaining of this information under predicted conditions. It is necessary to estimate possibilities and indicate ways for the indirect estimation of parameters, if necessary;
    - Definition of strategy for implementation of the corrective actions by the DS personnel directed to safety achievement at all severity levels of beyond the design basis accident.