

**Document Preparation Profile (DPP)  
Version 3 dated 3 April 2019**

## 1. IDENTIFICATION

**Document Category:** Specific Safety Guides

**Working ID:** DS517

**Proposed Titles:**

- **Safety of Conversion Facilities and Uranium Enrichment Facilities;**
- **Safety of Uranium Fuel Fabrication Facilities;**
- **Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities.**

**Proposed Action:** Revision by amendment of 3 Specific Safety Guides on Nuclear Fuel Cycle Facilities as a set of publications:

- **SSG-5: Safety of Conversion Facilities and Uranium Enrichment Facilities;**
- **SSG-6: Safety of Uranium Fuel Fabrication Facilities;**
- **SSG-7: Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities.**

**Review Committee(s):** NUSSC, RASSC, WASSC, EPR<sub>e</sub>SC, NSGC

**Technical Officer(s):** Ramon GATER, Juraj ROVNY

## 2. BACKGROUND

The IAEA Safety Standards related to the safety of nuclear fuel cycle facilities include IAEA Safety Standards Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities (2017), and several Specific Safety Guides (referred to as Guides below). These Guides were all published before SSR-4 and represent the international consensus on the safety of nuclear fuel cycle facilities which existed in the period of their development and publication (2010). These Guides were used by many Member States as reference when establishing national safety regulations and implementing facility practices and may be used as a basis for the safety evaluation conducted during IAEA Safety Evaluation of Fuel Cycle Facilities during Operation (SEDO) missions.

The publication of SSR-4 in 2017 superseded IAEA Safety Standards Series No. NS-R-5, Safety of Nuclear Fuel Cycle Facilities (2014), and introduced some new requirements and significantly modified several others. To assess the extent of these changes, a gap analysis was used to compare the requirements in SSR-4 with the previous safety requirements in NS-R-5.

The gap analysis identified new or extended requirements in SSR-4, covering design extension conditions, control over transfers of radioactive material, qualification of structures, systems and components, design for cooling and for ageing, interfaces between safety, nuclear security and systems of accounting and control for nuclear material for which guidance is needed. Also, specific guidance for nuclear fuel cycle facilities in some areas was no longer consistent with SSR-4, including the guidance on: management and verification of safety, general design requirements, main safety functions, defence

in depth concept, safety analysis and operational limits and conditions, accident management and feedback of operating experience. The analysis also identified information in NS-R-5 that was not carried over to SSR-4 because it was more suitable for inclusion in guide-level publications, some of which may also need inclusion. Finally, the guidance on safety functions in these Guides does not reflect developments in functional safety for control systems and electrical power.

The analysis confirmed that much of the existing technical contents of these Guides remains valid, but has outdated references and does not fully address all the requirements in SSR-4. Three Guides were found to need in-depth technical revision for the reasons highlighted above. More detailed analysis of the revisions needed to the guides is provided in the Annex to this DPP. The Guides will remain as separate publications.

These three Guides (SSG-5, SSG-6 and SSG-7) will be revised by amendment under one DPP. The other three guides related to the safety of nuclear fuel cycle facilities will be revised in two other groups. The groups are as follows:

#### Group 1

- IAEA Safety Standards Series No. SSG-5, Safety of Conversion Facilities and Uranium Enrichment Facilities, IAEA, Vienna (2010);
- IAEA Safety Standards Series No. SSG-6, Safety of Uranium Fuel Fabrication Facilities, IAEA, Vienna (2010);
- IAEA Safety Standards Series No. SSG-7, Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities, IAEA, Vienna (2010).

#### Group 2

- IAEA Safety Standards Series No. SSG-42, Safety of Nuclear Fuel Reprocessing Facilities, IAEA, Vienna (2017);
- IAEA Safety Standards Series No. SSG-43, Safety of Nuclear Fuel Cycle Research and Development Facilities, IAEA, Vienna (2017).

#### Group 3

- IAEA Safety Standards Series No. SSG-27, Criticality Safety in the Handling of Fissile Material, IAEA, Vienna (2014).

The criteria to group the Safety Guides by three DPPs are based on the gap analysis and defined by time of the publication, technical matters covered and resource allocation. Safety Guides in Group 1 (SSG-5, SSG-6 and SSG-7) were developed before publishing most of IAEA General Safety Requirements and before the accident at the Fukushima Daiichi nuclear power plant and require significant revision. Safety Guides in Group 2 (SSG-42 and SSG-43) were published recently (2017), they considered lessons learned from Fukushima-Daiichi accident and need only minor modification. SSG-27 in Group 3 covers specific area of nuclear safety – criticality safety – it is applied to all nuclear facilities where fissile materials are handled and needs involvement of specialized technical experts for revision. Another reason to divide the guides for revision into three DPPs is to adapt IAEA staff resources and to reduce pressure on Member States for reviewing the documents by applying time shift for preparing the drafts for different DPPs and for submission to Member States for reviewing.

### **3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENTS**

The Guides were developed to provide recommendations on fulfilling the previous Safety Requirements NS-R-5. Since the new Safety Requirements SSR-4 represent a significant development it is now necessary to revise these Guides for consistency with SSR-4. In addition, the Guides were published before most of the General Safety Requirements and several other Safety Standards relevant to nuclear

fuel cycle facilities. As such, the Guides contain many references to superseded Safety Standards and do not fully address the current requirements.

The revision of the Guides covered by this DPP will take into consideration the following:

- The new and modified requirements in SSR-4 and the revision of the General Safety Requirements, along with developments in other IAEA Safety Standards;
- Long Term Structure of the IAEA Safety Standards;
- Feedback from the users of the IAEA Safety Standards related to nuclear fuel cycle facilities;
- Lessons from the accident at the Fukushima Daiichi nuclear power plant and other events in the nuclear industry, including those occurring at nuclear fuel cycle facilities that were reported to Fuel Incident Notification and Analysis System (FINAS);
- Experience gained from SEDO missions.

More specifically, amendments to the Guides are needed to address the following:

1. All the content of the Guides will be checked against Appendixes and Annexes of NS-R-5 that were removed when replaced by SSR-4.
2. Some statements in the Guides that are expressed as “should” statements may now duplicate requirements of SSR-4 and GSR Parts 2-7. Such statements should be carefully checked and either removed from the Guides or modified to make them useful recommendations.
3. Other new IAEA Safety Standards have been developed to support the GSRs and Specific Requirements NS-R-3 (Rev.1) which also apply to nuclear fuel cycle facilities. These Safety Guides should be referenced in the Guides where necessary, along with other documents Safety Series that are relevant.
4. The Guides have to be updated to better reflect current operational practices at nuclear fuel cycle facilities and the state-of-the-art in relevant technologies.
5. The provision of SSGs that are specific to facility types should address the principal concern of applying graded approach to SSR-4. The effect of application of the graded approach to the particular type of the facility should be explained, where fulfilling the Guide addresses the graded element of the requirements of SSR-4.
6. SSR-4 contains a new requirement relating to the interfaces between safety, nuclear security and the State system of accounting for, and control of, nuclear material. Interfaces between safety and security will be covered, in a consistent manner with nuclear security recommendations for physical protection and insider threats, where appropriate.
7. Relevant operational experience feedback will be considered when revising the Guides.

These updates have been grouped in 3 separate DPPs to take account for the limited resource in Member States for their review and in IAEA for their production.

#### **4. OBJECTIVE**

The objective of the revised Guides is to provide operating organizations, regulatory bodies and other organizations involved in the safety of nuclear fuel cycle facilities with guidance on meeting the requirements of SSR-4 and applicable General Safety Requirements. The revised Guides should provide comprehensive, consistent and up-to-date guidance for implementing the safety requirements in SSR-4 and the General Safety Requirements. Account will be taken of relevant advances in knowledge, technology and regulations of Member States in this field.

## 5. SCOPE

The revised Guides will cover all areas important to the safety of the specified types of nuclear fuel cycle facilities. The Guides cover all stages in the lifetime of these facilities, including site evaluation, design, construction, commissioning, operation and preparation for decommissioning.

The scope of all revised Guides remains generally unchanged. For all three Safety Guides, the following cross-cutting issues will be addressed consistently:

- New section on management and verification of safety, aligned with SSR-4 and the more relevant management safety guide GS-G-3.5;
- Align discussion of the graded approach with SSR-4;
- Align with SSR-4 on descriptions of topics such as: main safety functions; safety classification; human factors engineering, design for ageing; classification and qualification of items important to safety;
- Information on interfaces between safety and security to be considered in sections where appropriate;
- Application of defence-in-depth concept to design and operation;
- Influence of human, technology and organisation approach in GSR Part 2, systemic approach to safety, leadership and safety culture;
- Requirements in SSR-4 that are not fully addressed in the Guides include: Req. 21 Design extension conditions; Req.27 Human factors engineering, Req. 28 Control over the transfer of radioactive material and other hazardous material; Req. 30 Qualification of items important to safety; Req. 39 Design of provisions for heat removal; Req. 59 Conduct of safety related activities; Req. 62 Records and Reports; Req. 64 Operational housekeeping and material conditions; Req. 71 Operational accident management programme; Req. 73 Feedback of operating experience and Req. 75 Interfaces between safety, nuclear security and the State system of accounting for, and control of, nuclear material;
- The guidance on ageing management does not fully address Req. 32 Design considerations for management of ageing and Req. 60 Ageing management during operation. Ageing management is one of the main issues facing the worldwide fleet of nuclear fuel cycle facilities. The gap analysis indicated that recommendations need to be revised on ageing management and on maintenance, periodic testing and inspection of nuclear fuel cycle facilities to support Member States in enhancing safety in these areas. The NEA publication Technical Opinion Paper on ageing management in 2012 (TOP 15) will also be taken into account;
- Align with SSR-4 on operational limits and conditions (Req. 18 and Req.57) and provide examples where missing;
- Align with SSR-4 Req. 53 on the construction programme;
- Provide more guidance on functions of the operating organization including operating procedures, ageing management, maintenance and modifications, quality management system, retraining, which are to be established and documented in accordance with a graded approach;
- Lessons from the Fukushima Daiichi accident and feedback from operational experience;
- Check guidance against new ISO standards for criticality control;
- Update references;

- Changes to section titles (e.g. “decommissioning” to “preparation for decommissioning”) following publication of SSR-4. Text specific to decommissioning (not preparation) will be removed.

In addition, the following revisions, specific to individual Guides are needed as follows.

The following specific issues will be addressed for SSG-5:

- Include auxiliary activities such as sampling, homogenization and blending within scope;
- Include guidance on use of water for cleaning cylinders with heels;
- Consider hazardous material assessments for uranium hexafluoride;
- Include safety culture aspects specific for conversion facilities and uranium enrichment facilities;
- Include the information on support systems and analytical laboratories;
- Check for consistency with SSG-27 (which is being revised in parallel).

The following specific issues will be addressed for SSG-6:

- Keep the scope to commercial uranium below 6% and confirm that fuel fabrication with reprocessed U containing traces of Pu is covered;
- Include auxiliary activities such as sampling, homogenization and blending within scope;
- Consider hazardous material assessments for uranium hexafluoride;
- Include the information on support systems and analytical laboratories;
- Include safety culture aspects specific for uranium fuel fabrication facilities;
- Check for consistency with SSG-27 (which is being updated in parallel).

The following specific issues will be addressed for SSG-7:

- Include auxiliary activities such as sampling, homogenization and blending within scope;
- Include safety culture aspects specific for uranium and plutonium mixed oxide fuel fabrication facilities;
- Include the information on support systems and analytical laboratories;
- Check for consistency with SSG-27 (which is being updated in parallel).

The Annex to this DPP provides more information on these changes.

## **6. PLACE IN THE OVERALL STRUCTURE OF THE RELEVANT SERIES AND INTERFACES WITH EXISTING AND/OR PLANNED PUBLICATIONS**

The revised publications in this DPP are facility-specific, supporting the application of SSR-4 and other relevant IAEA Safety Standards. The Guides interface with the following Standards and other publications (this is not, and cannot be, regarded as an exclusive or exhaustive list):

- IAEA Safety Standards Series No SSR-4, Safety of Nuclear Fuel Cycle Facilities, IAEA, Vienna (2017);
- IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA, Vienna (2014);

- IAEA Safety Standards Series No. GSR Part 4, (Rev.1) Safety Assessment for Facilities and Activities, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. GSR Part 5, Predisposal Management of Radioactive Waste, IAEA, Vienna (2009);
- IAEA Safety Standards Series No. GSR Part 6, Decommissioning of Facilities, IAEA, Vienna (2014);
- IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA, Vienna (2015);
- IAEA Safety Standards Series No. NS-R-3 (Rev. 1), Site Evaluation for Nuclear Installations, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. SSG-30, Safety Classification of Structures, Systems and Components in Nuclear Power Plants (2014);
- IAEA Safety Standards Series No. SSG-41, Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities, IAEA, Vienna (2016);
- IAEA Safety Standards Series No. SSG-27, Criticality Safety in the Handling of Fissile Material, IAEA, Vienna (2014);
- IAEA Safety Standards Series No. GS-G-3.1, Application of the Management System for Facilities and Activities, IAEA, Vienna (2006) (revised under DS513);
- IAEA Safety Standards Series No. GS-G-3.5, The Management System for Nuclear Installations, IAEA, Vienna (2009) (revised under DS513);
- IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/ Revision 5), IAEA, Vienna (2011);
- IAEA Nuclear Security Series No. 14, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA, Vienna (2011).

Other IAEA publications may be referenced where appropriate:

- IAEA-TECDOC-771, Manual on safe production, transport, handling and storage of uranium hexafluoride, IAEA, Vienna (1994) (*being revised and updated*);
- IAEA-TECDOC-994, Guidelines for Integrated Risk Assessment and Management in Large Industrial Areas, IAEA, Vienna (1998);
- IAEA-TECDOC-1115, Minimization of waste from uranium purification, enrichment and fuel fabrication, IAEA, Vienna (1999);
- IAEA-TECDOC-1241, Implementation of burnup credit in spent fuel management systems, IAEA, Vienna (2000);
- IAEA-TECDOC-1250, Seismic design considerations of nuclear fuel cycle facilities, IAEA, Vienna (1998);
- IAEA-TECDOC-1267, Procedures for conducting probabilistic safety assessment for non-reactor nuclear facilities, IAEA, Vienna (2002);
- IAEA TECDOC-1306, Environmental aspects based on operational performance of nuclear fuel fabrication facilities, IAEA, Vienna (2002).

References to publications by international organizations will be considered.

The development of these documents will be coordinated with other relevant sections and divisions of NS, including the Incident and Emergency Coordination section.

## **7. OVERVIEW**

The proposed structure of each Guide will be similar to the structure of the current Guides at Section level. The sub-section structural level titles will be modified to align with the structure and content of SSR-4, to provide consistency and ensure adequate coverage of the requirements in SSR-4.

The initial revision of all six SSG for nuclear fuel cycle facilities, presented in Section 2, will be conducted in parallel to ensure consistency with each other. Subsequently, presentation of the drafts to committees and for Member State review will be phased to allow for limited resource available.

The revised Guides will be published as individual Guides, as before.

### **Revision of SSG-5, 6 and 7**

These safety Guides make recommendations on how to meet the requirements established in SSR-4 and Generic Safety Requirements publications.

The proposed structure for all these SSG is as follows:

1. Introduction
  - Background
  - Objective
  - Scope
  - Structure
2. General considerations
3. Management and verification of safety (new)
  - Responsibility
  - Safety Policy
  - Management System
  - Verification of Safety
4. Site evaluation
5. Design
  - General
  - Design and safety assessment
  - Design basis
  - Specific recommendations for design
  - Provisions for the lifetime of a facility
  - Radiation protection
  - Design for criticality safety
  - Design for protection against non-radiological hazards
  - Instrumentation and control systems
  - Design for radioactive waste management
  - Design for the management of atmospheric and liquid discharges
  - Design for emergency preparedness and response
  - Other specific provisions
6. Construction
7. Commissioning
8. Operation
  - General
  - Organization
  - Management of operational safety
  - Facility operations
  - Maintenance, periodic testing and inspection
  - Nuclear criticality safety
  - Radiation protection programme
  - Management of radioactive waste and effluents
  - Operational safety programmes

## Emergency preparedness and response

## 9. Preparation for decommissioning

## References

Annex I: Typical process routes in facility (additional annexes as necessary)

Annex II: Structures, systems and components important to safety

Annex III Sample OLC either in separate annex or merged with Annex II.

Contributors to drafting and review

**8. PRODUCTION SCHEDULE**

To reduce pressure on MS review of three similar documents, it is proposed to seek MS comment on one of the guides, so that account of generic feedback can be taken in the other two.

The provisional schedule for document preparation, showing expected dates for each step follows:

STEP 1: Preparing a DPP	Q3 2018
STEP 2: Approval of DPP by the Coordination Committee	Q3 2018
STEP 3: Approval of DPP by the relevant review Committees	Q4 2018
STEP 4: Approval of DPP by the CSS	Q2 2019
STEP 5: Preparing the draft 2 consultancy meetings are expected to be organized for the preparation of the drafts	Q2 2019 – Q1 2020
STEP 6: Approval of draft by the Coordination Committee	Q1 2020
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	Q2 2020
STEP 8: Soliciting comments by Member States	Q3 2020
STEP 9: Addressing comments by Member States	Q4 2020
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	Q1 2021
STEP 11: Approval by the relevant review Committees	Q2 2021
STEP 12: Endorsement by the CSS	Q4 2021
STEP 13: Establishment by the Publications Committee	Q4 2021
STEP 14: Target publication date	Q2 2022

**9. RESOURCES**

Staff: 20 staff weeks

Consultants: 15 consultant weeks

## ANNEX: MAIN REVISIONS TO THE GUIDES

The following tables present the main revisions to the Guides at the Section level. These revisions were identified by detailed comparison of SSR-4 with NS-R-5 and the analysis described in Section 2 of this DPP.

<b>SSG-5: Safety of Conversion Facilities and Enrichment Facilities</b>	
<b>Section</b>	<b>Main Revisions</b>
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-4
2	Specify the generic information on applying concept of defence in depth and how graded approach can be applied to implement the requirements of SSR-4 to the safety of conversion and enrichment facilities when allowance for specific technology and the inventory is made.
3	The objective of this new Section is to focus on how the specific topic of the safety guide is covered in the management system and verification of safety following the content and structure of relevant section of SSR-4 and GSR Part 2.
4	Update references. Check consistency and adequacy with SSR-4 and NS-R-3 (Rev. 1)
5	The following should be made consistent with SSR-4: the definition of safety functions; concept of defence in depth; safety classification; design for ageing; operational limits and conditions (introduce Annex II listing examples of operational limits and conditions); internal and external hazards, combined postulated initiating events and design extension conditions; classification and qualification of items important to safety. Include information on support systems and analytical laboratories.
6	Check consistency and adequacy with SSR-4 and particularly Req. 53 on the construction programme. Update references to include SSG-38.
7	Check consistency and adequacy with SSR-4.
8	Check consistency and adequacy with SSR-4 and GSR Part 7. Provide guidance on: the functions of the operating organization; main safety programmes, operating procedures; ageing management, maintenance and modifications, retraining, use of operational limits and conditions.
9	Text specific to decommissioning (not preparation) should be removed.
Annex I	Possible update
Annex II	Check consistency with SSR-4. Include such auxiliary activities as sampling, homogenization and blending to the flowchart
Annex III	Check consistency with SSR-4. If there is a benefit for the target user, merge previous Annex III with Annex II.

<b>SSG-6: Safety of Uranium Fuel Fabrication Facilities</b>	
<b>Section</b>	<b>Main Revisions</b>
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-4. Keep the scope to commercial uranium below 6%. Clarify that fuel fabricated with reprocessed U containing traces of Pu is covered by SSG-6.
2	Specify the generic information on applying concept of defence in depth and how graded approach can be applied to implement the requirements of SSR-4 to the safety of fuel fabrication facilities when allowance for specific technology and the inventory is made.
3	The objective of this new Section is to focus on how the specific topic of the safety guide is covered in the management system and verification of safety following the content and structure of relevant section of SSR-4 and GSR Part 2.
4	Update references. Check consistency and adequacy with SSR-4 and NS-R-3 (Rev. 1).
5	The following should be made consistent with SSR-4: the definition of safety function; concept of defence in depth; safety classification; design for ageing; operational limits and conditions (introduce Annex II listing examples of operational limits and conditions); internal and external hazards, combined postulated initiating events and design extension conditions; classification and qualification of items important to safety.
6	Check consistency and adequacy with SSR-4 and particularly Req. 53 on the construction programme. Update references to include SSG-38.
7	Check consistency and adequacy of SSG with SSR-4.
8	Check consistency and adequacy with SSR-4 and GSR Part 7. Provide guidance on: the functions of the operating organization; main safety programmes, operating procedures; ageing management, maintenance and modifications, retraining, use of operational limits and conditions.
9	Text specific to decommissioning (not preparation) should be removed.
Annex I	Possible update
Annex II	Possible update
Annex III	Check consistency with SSR-4
Annex IV	Check consistency with SSR-4

<b>SSG-7: Safety of Uranium and Plutonium Mixed Oxide Fuel Fabrication Facilities</b>	
<b>Section</b>	<b>Main Revisions</b>
1	Standardize background, objective and scope. Align discussion of graded approach with the new text in SSR-4.
2	Specify the generic information on applying concept of defence in depth and how graded approach can be applied to implement the requirements of SSR-4 to the safety of uranium and plutonium mixed oxide facilities when allowance for specific technology and the inventory is made.
3	The objective of this new Section is to focus on how the specific topic of the safety guide is covered in the management system and verification of safety following the content and structure of relevant section of SSR-4 and GSR Part 2.
4	Update references. Check consistency and adequacy with SSR-4 and NS-R-3 (Rev. 1).
5	The following should be made consistent with SSR-4: the definition of safety functions; concept of defence in depth; safety classification; design for ageing; operational limits and conditions (introduce Annex II listing examples of operational limits and conditions); internal and external hazards, combined postulated initiating events and design extension conditions; classification and qualification of items important to safety.
6	Check consistency and adequacy with SSR-4 and particularly Req. 53 on the construction programme. Update references to include SSG-38.
7	Check consistency and adequacy of SSG with SSR-4.
8	Check consistency and adequacy with SSR-4 and GSR Part 7. Provide guidance on: functions of the operating organization; main safety programmes, operating procedures; ageing management, maintenance and modifications, retraining, use of operational limits and conditions. Expand para 7.39, criticality safety in maintenance (relevant OEF). Cover blending and sampling.
9	Text specific to decommissioning (not preparation) should be removed.
Annex I	Possible update
Annex II	Check consist with SSR-4. If beneficial for target users, merge previous Annex II with Annex III.
Annex III	Check consistency with SSR-4. If there is a benefit for the target user, merge previous Annex III with Annex II.