

**SPESS F**  
**Document Preparation Profile (DPP)**  
**Version 4 dated 01 February 2017**

## 1. IDENTIFICATION

**Document Category or set of publications to be revised in a concomitant manner**

**General Safety Guide**

**Working ID:** DS505

**Proposed Title:** **Source Monitoring, Environmental Monitoring and Individual Monitoring for Protection of the Public and the Environment**

**Proposed Action:** **Revision of “Environmental and Source Monitoring for Purposes of Radiation Protection”, 2005, Safety Guide, IAEA No. RS-G-1.8**

**Review Committee(s) or Group:** WASSC, RASSC, NUSSC, EPReSC

**Technical Officer(s):** T.L. Yankovich, NSW

## 2. BACKGROUND

The authorized discharge of limited amounts of radionuclides to the environments is a legitimate practice in the nuclear industry and from other facilities (IAEA Safety Glossary, 2016). Monitoring of discharges and of relevant environmental media is a key regulatory requirement in order to ensure compliance with radiological criteria for **controlling exposure** of the public **and protecting the environment**. In some cases, unplanned and uncontrolled releases of radionuclides to the environment may occur in a nuclear or radiological emergency; in other cases, unplanned and uncontrolled releases may be due to past practices that were not regulated in accordance with current safety standards.

The planning and establishment of robust, fit-for-purpose monitoring programmes **are** essential **aspects** of demonstrating and verifying regulatory compliance, for example, to fulfil the licence conditions for an authorized facility. Such monitoring programmes should take **into** account the stage in the lifetime of the facility or activity. **These** programmes can be established using a step-wise approach to **ensure consistency with** IAEA safety requirements, **as well as good practices**. In addition, in existing exposure situations and emergency exposure situations, monitoring is used to characterize the prevailing conditions, to assess exposure of members of the public, and to determine the necessary protective actions and other response actions, and remedial actions to be taken, including those that may remain in place in the long term.

The interpretation of monitoring results requires site characterization involving the “determination of the nature and activity of radionuclides present in a specified place” (IAEA Safety Glossary, 2016). Characterization is typically undertaken **as part of** the site evaluation **as a** basis for the environmental impact assessment, as well as to identify key environmental pathways in support of the planning and implementation of monitoring programmes for facilities and activities. Characterization may also be necessary during the operation and post-operation stages of a facility.

The proposed update to RS-G-1.8 will address these and other aspects related to characterization and monitoring for the protection of the public and the environment. A summary of new information and

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relevant feedback from Member States and the Secretariat is provided in the *Feedback Analysis Report (Appendix I)*.

### 3. JUSTIFICATION FOR THE PRODUCTION OF THE DOCUMENT

The Safety Guide on “*Environmental and Source Monitoring for Purposes of Radiation Protection*” (IAEA Safety Standards Series No. RS-G-1.8) was published in 2005. Since then, the IAEA Safety Fundamentals SF-1 and underlying Safety Standards, including GSR Part 3 on radiation protection, GSR Part 7 on emergency preparedness and response, GSR Part 1 (Rev. 1) on the governmental, legal and regulatory framework for safety, GSR Part 4 (Rev. 1) on safety assessment for facilities and activities, and others have been published. As a result, fundamental concepts presented in RS-G-1.8, such as the need to consider radiological environmental impacts, the three different types of exposure situation (planned, emergency, and existing), the principles of justification, optimization and limitation, the usage of terminology including the term ‘environmental monitoring’, and other aspects, are not in line with the current Safety Standards. **In addition**, there is a need to revise RS-G-1.8 to improve consistency with current IAEA Safety Standards, as well as those under development.

A review was carried out in order to assess these inconsistencies and to identify areas that require revision in the current RS-G-1.8. The following areas proved to **justify** update **through** elaboration or inclusion in the revision of RS-G-1.8:

- Application of the principles of justification, optimization and limitation in planning source monitoring and environmental monitoring for planned, **emergency**, and existing exposure situations;
- Application of a graded approach in developing and implementing a strategy for monitoring and monitoring programmes;
- The relationship between characterization and monitoring, and their relevance to regulatory **activities** and functions **for assessment of safety** (such as environmental impact assessment, authorization, inspection, and enforcement);
- Level of characterization and monitoring required **in** different **circumstances and** stages of the lifetime of different facilities and activities;
- The relationship between monitoring and modelling, so that characterization and monitoring can be clearly linked to demonstration of regulatory compliance in planned, **emergency**, and existing exposure situations;
- Planning and implementation of a harmonized monitoring strategy and programmes for protection of people and the environment in planned, **emergency**, and existing exposure situations;
- Making use of monitoring data to inform decisions relating to protection of people and the environment (adaptive management of monitoring programmes);
- Further clarification of the roles and responsibilities of the regulatory body, the operating organization, and various relevant authorities and organizations, for example, in relation to reporting in case of multiple jurisdictions, communication and consultation with interested parties, **etc.**;
- Further guidance on the supplementary characterization and monitoring of parameters other than radioactivity (e.g. meteorological data, water budget, flow rates, **etc.**) that

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should be considered to allow for adequate dose assessment and assessment of overall impacts;

- Data management, quality management, and handling of large datasets, to reflect advances made in these areas;
- **Transboundary issues and international exchange of monitoring data (role of the IAEA), international legal instruments (conventions, agreements, etc.).**

The update will also take into account technological advances, such as instrumentation to improve resolution of radiological measurements, data management systems, analytical and software tools, and tools for trend analysis, that have become available since RS-G-1.8 was published.

In addition, the update will also consider relevant sources of information from other organizations (e.g. UNEP, ICRU, UNSCEAR, ICRP), as well as lessons from experience (e.g. the IAEA Report on the Fukushima Daiichi Accident).

Additional details regarding proposed changes to RS-G-1.8 and corresponding justification can be found in the Feedback Analysis Report provided in *Appendix I* below.

#### **4. OBJECTIVE**

The objective of the revised Safety Guide is to provide guidance on the planning and implementation of characterization and monitoring, in order to demonstrate and verify compliance with regulatory requirements, as well as to support effective protection of people and the environment, as appropriate. This Safety Guide will also provide guidance on the use of source, environmental and individual monitoring for the purposes of assessment of radiological impacts on and consequences for the public and, as appropriate, the environment, in accordance with relevant IAEA Safety Standards (e.g. GSR Part 3 and GSR Part 7).

The Safety Guide is intended for use by regulatory bodies, operating organizations, decision-makers and others responsible for **developing monitoring strategy**, planning and implementing source, environmental, and individual monitoring and interpreting monitoring data in relation to planned, existing or emergency exposure situations.

#### **5. SCOPE**

The Safety Guide will apply for all facilities and activities over the different stages of their lifetimes. It will address characterization and monitoring in relation to planned, emergency and existing exposure situations.

This Safety Guide will primarily be concerned with source monitoring and environmental monitoring of discharges from authorized (registered or licensed) facilities and activities, as well as source, environmental and individual monitoring for unplanned and uncontrolled releases, with the aim of protecting the public and the environment from harmful effects of ionizing radiation or, when appropriate, to demonstrate the protection of the public and the environment.

The Safety Guide will provide guidance on the appropriate level of characterization and monitoring, while applying a graded approach based on the potential hazards and impacts associated with the three exposure situations. The Safety Guide will also provide guidance on the interpretation of results, including for dose assessment.

**The Safety Guide will cover individual monitoring of members of the public in existing and emergency exposure situations.**

The Safety Guide will not cover monitoring of non-radiological contaminants or physical stressors; however, the Safety Guide will give consideration on all types of impacts and stressors that should be taken into account in the justification and optimization processes, as well as in the overall environmental impact assessment for a facility or activity.

This Safety Guide will not address the monitoring of workers and the workplace. Monitoring of emergency workers **and helpers** will also not be addressed. In addition, this Safety Guide will not cover monitoring for the purposes of protection of patients.

**This Safety Guide also will not address the monitoring of disposal facilities, as this is addressed in SSG-31.**

The Safety Guide will also not address characterization and monitoring for nuclear security purposes.

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

The proposed Safety Guide will be developed as part of the IAEA Safety Standards Series, taking due account of existing Safety Standards, such as the General Safety Requirements for the governmental, legal and regulatory framework, radiation protection and safety ~~sources of radiation~~, safety assessment and emergency preparedness and response.

As applicable, it will be necessary to coordinate the development of the revision of RS-G-1.8 with the revision of other relevant IAEA Safety Standards. The following sections will be consulted in the drafting process: the Waste and Environmental Safety Section, the Radiation Safety and Monitoring Section, the Regulatory Infrastructure and Transport Safety Section (all within the Division of Radiation, Transport and Waste Safety (NSRW)), and the Incident and Emergency Centre (IEC). Consultation with the Division of Nuclear Installation Safety (NSNI) may also be needed during drafting.

The proposed publication will be a General Safety Guide in the long-term structure of the IAEA Safety Standards Series. This document will interface with the following IAEA Safety Standards (the list is not intended to be final or exhaustive, due to the cross-cutting nature of source monitoring and environmental monitoring):

- Governmental, Legal and Regulatory Framework for Safety (GSR Part 1, Rev. 1) [2016]
- Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (GSR Part 3) [2014]
- Safety Assessment for Facilities and Activities (GSR Part 4, Rev. 1) [2016]
- Decommissioning of Facilities (GSR Part 6) [2014]
- Preparedness and Response for a Nuclear or Radiological Emergency (GSR Part 7) [2015]
- Application of the Concepts of Exclusion, Exemption and Clearance (RS-G-1.7) [2004]
- Monitoring and Surveillance of Near Surface Waste Disposal Facilities (SSG-31) [2014]
- Radiation Safety for Consumer Products (SSG-36) [2016]
- Safety of Nuclear Power Plants: Design (SSR-2/1, Rev. 1) [2016]
- Safety of Nuclear Power Plants: Commissioning and Operation (SSR-2/2, Rev. 1) [2016]
- Review and Assessment of Nuclear Facilities by the Regulatory Body (GS-G-1.2) [2002]

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- **Update to** Arrangements for Preparedness for a Nuclear or Radiological Emergency (GS-G-2.1) [2007] **(DS504)**
- Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency (GSG-2) [2011]
- The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste (GSG-3) [2013]
- Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants (NS-G-3.2) [2002]
- Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material (TS-G-1.2 (ST-3)) [2002]
- Release of Sites from Regulatory Control on Termination of Practices (WS-G-5.1) [2006]
- Prospective Radiological Environmental Impact Assessment for Facilities and Activities (DS427)
- Radiation Protection of the Public and the Environment (DS432)
- Regulatory Control of Radioactive Discharges to the Environment (DS442)
- Management of Radioactive Residues from Uranium Production and Other NORM Activities (DS459)
- Communication and Consultation with Interested Parties by the Regulatory Body (DS460)
- Remediation Process for Areas Affected by Past Accidents and Activities (DS468)
- Site Evaluation for Nuclear Installations (DS484)
- Arrangements for the Termination of a Nuclear or Radiological Emergency (DS474)

## 7. OVERVIEW

The Safety Guide is expected to have the following contents:

1. INTRODUCTION
  - 1.1 Background
  - 1.2 Objective
  - 1.3 Scope
  - 1.4 Structure
2. REQUIREMENTS FOR MONITORING
  - 2.1 Legal and regulatory framework
  - 2.2 Monitoring Needs for Different Exposure Situations
3. RESPONSIBILITIES FOR MONITORING
  - 3.1 Responsibilities of the government**
  - 3.2 Responsibilities of the operating organization
  - 3.3 Responsibilities of the regulatory body
  - 3.4 Responsibilities of other agencies
4. BASIC CONCEPTS RELEVANT TO MONITORING

- 4.1 General types of **monitoring (source monitoring, environmental monitoring and individual monitoring)**
- 4.2 **Fit-for-purpose** monitoring **and surveillance** (e.g. routine monitoring, follow up monitoring, monitoring for root cause analysis)
- 4.3 Human receptors and exposure pathways
- 4.4 Non-human receptors and exposure pathways
- 5. SETTING A STRATEGY FOR MONITORING AND PLANNING A MONITORING PROGRAMME
  - 5.1 Setting objectives
  - 5.2 Background information to support the development of a monitoring programme
  - 5.3 Development of a monitoring programme
  - 5.4 Sample collection and field measurements
  - 5.5 Laboratory sample analysis
  - 5.6 Data storage and management
  - 5.7 Quality **and uncertainty** management
  - 5.8 Data analysis, assessment and interpretation, and reporting
  - 5.9 Review of the monitoring strategy and programme **and consultation with interested parties**
  - 5.10 Evaluation and redesign
  - 5.11 **Training of personnel**
- 6. **Planned exposure situations**
  - 6.1 **Goals and objectives for monitoring**
  - 6.2 **Considerations for monitoring**
  - 6.3 **Considerations in dose assessment**
  - 6.4 **Interpretation, reporting, and communication of monitoring results**
  - 6.5 **Uncertainties in monitoring and dose assessment**
- 7. **Emergency exposure situations**
  - 7.1 **Goals and objectives for monitoring**
  - 7.2 **Considerations for monitoring**
  - 7.3 **Considerations in dose assessment**
  - 7.4 **Interpretation, reporting, and communication of monitoring results**
  - 7.5 **Uncertainties in monitoring and dose assessment**
- 8. **Existing exposure situations**
  - 8.1 **Goals and objectives for monitoring**
  - 8.2 **Considerations for monitoring**
  - 8.3 **Considerations in dose assessment**
  - 8.4 **Interpretation, reporting, and communication of monitoring results**
  - 8.5 **Uncertainties in monitoring and dose assessment**

REFERENCES

DEFINITIONS [as required]

APPENDICES or ANNEXES:

The following topics might be considered to be included:

- o Relationship between characterization and monitoring
- o How to design a monitoring programme
- o How to design a monitoring strategy including template strategy
- o Example to show how to select the representative person in all three exposure situations

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6.1 . Monitoring in planned exposure situations ¶  
6.2 . Monitoring in emergency exposure situations ¶  
6.3 . Monitoring in existing exposure situations ¶  
<#>CONSIDERATIONS IN DOSE ASSESSMENT¶  
7.1 . Planned exposure situations¶  
7.2 . Emergency exposure situations¶  
7.3 . Existing exposure situations ¶  
7.4 . Uncertainties in dose assessments ¶  
<#>INTERPRETATION OF MONITORING RESULTS ¶  
8.1 . Planned exposure situations¶  
8.2 . Emergency exposure situations¶  
8.3 . Existing exposure situations ¶

- Relationship between monitoring and modelling
- Regulatory instruments associated with characterization and monitoring
- **List of relevant references to complement DS505**

CONTRIBUTORS TO DRAFTING AND REVIEW

The proposed contents are based on the current RS-G-1.8, taking account of recent developments.

The Safety Guide is expected to be cosponsored by relevant international organizations such as UNEP. Coordination will be ensured by the Technical Officer throughout the drafting and review processes.

**8. PRODUCTION SCHEDULE:** Provisional schedule for preparation of the document, outlining realistic expected dates for each step:

	A
STEP 1: Preparing a DPP	DONE
STEP 2: Approval of DPP by the Coordination Committee	Q1 2017
STEP 3: Approval of DPP by the relevant review Committees	Q2 2017
STEP 4: Approval of DPP by the CSS	Q4 2017
STEP 5: Preparing the draft Indicate as to whether a TM is expected to be organized for the preparation of the draft	Q4 2017 – Q2 2019 (TM Q1 2019)
STEP 6: Approval of draft by the Coordination Committee	Q2 2019
STEP 7: Approval by the relevant review Committees for submission to Member States for comments	Q2 2019
STEP 8: Soliciting comments by Member States	Q2/Q3 2019
STEP 9: Addressing comments by Member States	Q4 2019
STEP 10: Approval of the revised draft by the Coordination Committee Review in NS-SSCS	Q1 2020
STEP 11: Approval by the relevant review Committees	Q2 2020
STEP 12: Endorsement by the CSS	Q4 2020
STEP 13: Establishment by the Publications Committee and/or Board of Governors (for SF and SR only))	Q1 2021
STEP 14: Target publication date	Q4 2021

**9. RESOURCES**

Estimated resources involved by the Secretariat (person-weeks) and the Member States (number and type of meetings)

- 5 CS meetings (4 consultants x 5 days for each CS meeting)
- 1 TM meeting (20 participants x 3 days)
- IAEA staff:
  - 1 Technical Officer – 20 person-weeks
  - 1 Administrative Assistant – 6 person-weeks



**APPENDIX I**  
**Feedback Analysis Report**

**On**

***RS-G-1.8 “Environmental and Source Monitoring for Purposes of Radiation Protection”***

**I. BACKGROUND:**

*To include information when the previous document has been published and the relevant changes in the SSs system since then.*

RS-G-1.8 on *Environmental and Source Monitoring for Purposes of Radiation Protection* was published in 2005, prior to the publication of the IAEA Safety Fundamentals SF-1, the General Safety Requirements GSR Part 3, GSR Part 6, GSR Part 7, and most other current IAEA Safety Standards.

The updates of the Safety Standards have led to the introduction of new concepts and usage of terminology directly relevant to RS-G-1.8. For example, the introduction of the need to demonstrate protection of the environment, which was introduced in SF-1 (at the top of the IAEA hierarchy of Safety Standards) in 2006, has been carried through to underlying Safety Requirements and Safety Guides, and has led to the development of a new Safety Guide on “*Prospective Radiological Environmental Impact Assessment for Facilities and Activities*” (DS427).

As environmental monitoring represents a key mechanism that is applied to demonstrate protection for all types of nuclear facilities and activities, as well as for all types of exposure situations, recent changes to other Safety Standards need to be incorporated in RS-G-1.8 to ensure consistency. This includes clarification of the definition of *environmental monitoring* within RS-G-1.8 to ensure consistency with current Standards, as the Safety Guide had been written with a focus of application of monitoring to demonstrate protection of people (assuming that the environment would also be protected).

Another key change to the Safety Standards that has been introduced following the publication of RS-G-1.8 is the establishment of three different types of exposure situations (planned, emergency, and existing), as well as the principles of justification, optimization and limitation, within GSR Part 3. These fundamental concepts of radiation protection will need to be captured in the update to RS-G-1.8.

In addition, GSR Part 7 on “*Preparedness and Response for a Nuclear or Radiological Emergency*” has been published, which includes requirements related to monitoring and assessment of the radiological situation and is relevant to RS-G-1.8.

**2. ISSUES AND BASIS FOR CHANGES:**

*To include identification of the major issues requiring attention/inclusion in the revised document and the basis (factual/criteria oriented) for the changes*

Due to the cross-cutting nature of environmental and source monitoring, the updates that have been made to the other Safety Standards have led to inconsistency between RS-G-1.8 and other Standards and a lack of clarity in the scope of the document, the presentation of key concepts, and the use of terminology. For example, the 2006 update to SF-1 identified that “*the fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation*”; however, in RS-G-1.8, the assumed purpose of environmental monitoring is protection of the public. As a result, throughout RS-G-1.8, a case-by-case review of the use of the term “*environmental monitoring*” is needed to determine whether it would be relevant to environmental monitoring for the purpose of protection of the public and/or protection of the environment itself.

Other fundamental concepts, such as protection and safety in the context of the three exposure situations (planned, emergency and existing), are not covered in RS-G-1.8 or are not consistent with current Safety Standards.

In addition to the updates to IAEA Safety Standards, there have also been significant technological advances possibly relevant to RS-G-1.8, such as in the measurement of radionuclides in different types of materials, as well as the handling of large volumes of data through application of database management and trend analysis software. Dose assessment models that can be applied in the integrated assessment of potential impacts to people and the environment have also been under development, for example, making use of characterization and monitoring data as input.

Finally, although RS-G-1.8 contains useful information and guidance, restructuring this information using a step-wise, process-based flow diagram could increase overall clarity and applicability of the Safety Guide to facilitate its implementation by Member States. In addition, RS-G-1.8 could benefit from the addition of examples, possibly as Appendices or Annexes, demonstrating how the guidance can be applied in practice.

### 3. AFFECTED SECTIONS OF THE SAFETY STANDARDS

*To mark the parts of the document needing amendment*

Amendment of the complete document is needed (i.e., Sections 1 and 11 of RS-G-1.8). In some cases, this will involve merging existing sections together, for example, such that guidance on the planning and establishment of a monitoring programme can be consolidated and presented in a step-wise manner.

### 4. IDENTIFICATION AND ANALYSIS OF ALTERNATIVE APPROACHES:

*Preliminary analysis of the alternative approaches performed by the IAEA Secretariat to address the work to be done.*

#### **Option 1:**

Option 1 is to open a complete revision of the document to ensure consistency with current IAEA Safety Standards and international good practice. The new document will provide guidance on characterization and monitoring as tools to ensure and demonstrate protection of the public and the environment. The guidance will be presented in the context of a step-wise, process-based flow diagram to facilitate implementation in Member States.

#### **Option 2:**

Option 2 is to open part of the document for revision.

This option would be extremely difficult to implement due to the cross-cutting nature of the topics covered in RS-G-1.8, the significant changes that have been made to complementary Safety Standards and international practice since the document was published in 2005, and the resultant gaps and the large number of inconsistencies in concepts and terminology that are currently present in the document. In addition, it would not be possible to restructure the document, as described under Option 1 (above), without opening most or all of RS-G-1.8, which would limit its implementability by Member States.

Option 2 is not recommended by the Secretariat.

## 5. RESOURCES IMPACTED:

### *Estimation of the resources needed (for Option 1)*

- 5 CS meetings (4 consultants x 5 days for each CS meeting)
- 1 TM meeting (20 participants x 3 days)
- IAEA staff:
  - 1 Technical Officer – 20 person-weeks
  - 1 administrative assistant – 6 person-weeks

## 6. RECOMMENDATIONS:

### *Recommendation by the IAEA Secretariat to revise or review the document*

The Secretariat recommends the Option 1 (to open the entire Safety Guide RS-G-1.8 for a complete revision), as this will ensure consistency with current Safety Standards and international advancements, especially given the significant changes in the Safety Standards that have occurred, since RS-G-1.8 was published.

In addition, the Secretariat recommends that IAEA Safety Report Series No. 64 (SRS 64) on “*Programmes and Systems for Source and Environmental Monitoring*”, issued in 2010 be reviewed and revised, to incorporate relevant changes captured in the update to RS-G-1.8 and to ensure consistency between the Safety Guide and the Safety Report. The update to SRS 64 can then complement the update to RS-G-1.8 and will provide more detailed guidance on implementation of the new Safety Guide.