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1. IDENTIFICATION

Document Category: **Safety Guide**

Working ID: **DS538**

Proposed Title: **Long Term Post-Remediation Management of Areas Affected by Past Activities or Events**

Proposed Action: **New publication**

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

Technical Officer(s): **Edgar Carvalho (NSRW/WES)**

2. BACKGROUND

Residual radioactive contamination in areas affected by past activities or events may pose risks to people and the environment. These are exposure situations that already exist when a decision is taken on the need for control. The affected areas can vary widely in size and level of impact and require substantial commitments of resources in terms of time, funding, personnel and capabilities for the implementation of remediation programmes.

Remediation is defined in the IAEA Safety Glossary (2018 Edition) as "Any measures that may be carried out to reduce the radiation exposure due to existing contamination of land areas through actions applied to the contamination itself (the source) or to the exposure pathways to humans." Complete removal of contamination is not implied.

When contamination is not completely removed, it is necessary to manage the risks from residual contamination through the use of controls to restrict the uses of the remediated areas and to maintain control over the source and exposure pathways in the long term. In recent decades, States have made progress in the remediation of areas affected by past activities or events, which has led to a gradual shift in focus to the post-remediation management of these areas to ensure the long term protection of people and the environment.

IAEA Safety Standards Series No. GSG-15, Remediation Strategy and Process of Remediation of Areas Affected by Past Activities or Events (in publication), provides general recommendations for the remediation process, including post-remediation management. However, as the gap analysis (see Annex) indicates, there is currently no specific guidance for the implementation of a comprehensive and integrated approach to post-remediation management that ensures the continued effectiveness of remediation and the protection of people and the environment in the long term.

3. JUSTIFICATION FOR THE PRODUCTION OF THE PUBLICATION

GSG-15 provides general recommendations on the strategy and remediation process of areas affected by past activities or events. GSG-15 does not, however, include specific recommendations relating to topics relevant to the post-remediation phase. The development of this new Safety Guide will address this gap.

The long term management of remediated sites has been identified by WASSC as a priority for its ninth term (2021–2023). At the 52nd WASSC meeting held in October 2021, the Committee requested the Secretariat to develop a DPP for a new Safety Guide to assist Member States in the planning, implementation and periodic review of the long term management of remediated sites.

The need for guidance relating to the safe management of remediated sites and establishing and maintaining institutional controls has been identified as one of the priorities by the International Working Forum on Regulatory Supervision of Legacy Sites (RSLS) in the "Work Plan 2021–2024".

The Coordination Group for Uranium Legacy Sites (CGULS) identified at its Annual Meeting held in 2021 the need to develop guidance on long term management of remediated areas. In addition, the Technical Meeting on the Planning and Implementation of Long-Term Institutional Controls and on the Release of Sites from Regulatory Control, held in 2017, resulted in a request from Member States for a publication on institutional controls for both short and long term situations.

The new Safety Guide will also provide the basis for conducting the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) as regards to remediation and post-remediation management, to ensure a comprehensive and integrated approach to the lifecycle of remediation of areas affected by residual radioactive materials from past activities or events.

4. OBJECTIVE

The objective of the proposed Safety Guide is to provide recommendations on the planning and implementation of long term post-remediation management of areas affected by past activities or events. These recommendations will support States in meeting the requirements of IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, and other applicable safety requirements and recommendations (e.g. GSG-15).

The proposed Safety Guide is intended to be used by decision makers, regulatory bodies, technical support organizations, implementers, community groups, local organizations and other interested parties involved in remediation and post-remediation management.

5. SCOPE

The scope of the proposed Safety Guide covers the post-remediation management of areas affected by residual radioactive material, considered within the requirements established in GSR part 3 for existing exposure situations. This includes areas that have undergone remediation, areas for which remediation has been considered and determined not to be justified or optimal, but are where 'post-remediation management' is necessary, and areas for which remediation or post-remediation management activities are being planned, including:

(a) Areas affected by past activities that were never subject to regulatory control, or that were subject to regulatory control but not in accordance with current requirements.

(b) Areas where regulatory control has evolved to meet current standards, but where contamination exists because of past activities, resulting in the need for a combination of decommissioning and remediation. Such areas may include those that have been affected by past activities that are considered existing exposure situations, but which also contain authorized facilities or activities that are being operated in accordance with the requirements for planned exposure situations. For such a 'hybrid' area, the decommissioning is outside the scope of this Safety Guide, whereas the remediation is within the scope.

(c) Areas affected by a nuclear or radiological emergency, after the emergency has been declared to be ended.

The proposed Safety Guide focuses on post-remediation management to ensure long term protection of people and the environment against radiation risks. Non-radiological risks are excluded from this Safety Guide, the relationship between radiological and non-radiological risks should be considered in the context of an integrated approach for remediation and post-remediation.

The proposed Safety Guide does not cover decommissioned facilities or closed radioactive waste disposal facilities that have been released from regulatory control with restrictions. However, some of the specific recommendations could be applicable to such sites.

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

In the long term structure of the IAEA safety standards, the proposed publication will be a Specific Safety Guide.

The proposed publication will interface with the following IAEA safety standards and other publications (this is not an exhaustive list):

1) EUROPEAN ATOMIC ENERGY COMMUNITY, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).

2) INTERNATIONAL ATOMIC ENERGY AGENCY, IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection, 2018 Edition, IAEA, Vienna (2019).

3) INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), IAEA, Vienna (2016).

4) INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, IAEA Safety Standards Series No. GSR Part 2, IAEA, Vienna (2016).

5) EUROPEAN COMMISSION, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Radiation Protection and Safety of

Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).

6) INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), IAEA, Vienna (2016).

7) INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009).

8) INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014).

9) FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, UNITED NATIONS OFFICE FOR THE CO¬ORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).

10) INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR-5, IAEA, Vienna (2011).

11) INTERNATIONAL ATOMIC ENERGY AGENCY, Communication and Consultation with Interested Parties by the Regulatory Body, IAEA Safety Standards Series No. GSG-6, IAEA, Vienna (2017).

12) INTERNATIONAL ATOMIC ENERGY AGENCY, UNITED NATIONS ENVIRONMENT PROGRAMME, Radiation Protection of the Public and the Environment, IAEA Safety Standards Series No. GSG-8, IAEA, Vienna (2018).

13) INTERNATIONAL ATOMIC ENERGY AGENCY, UNITED NATIONS ENVIRONMENT PROGRAMME, Regulatory Control of Radioactive Discharges to the Environment, IAEA Safety Standards Series No. GSG-9, IAEA, Vienna (2018).

14) INTERNATIONAL ATOMIC ENERGY AGENCY, UNITED NATIONS ENVIRONMENT PROGRAMME, Prospective Radiological Environmental Impact Analysis for Facilities and Activities, IAEA Safety Standards Series No. GSG-10, IAEA, Vienna (2018).

15) FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR OFFICE, INTERNATIONAL MARITIME PORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Arrangements for the Termination of a Nuclear or Radiological 138 Emergency, IAEA Safety Standards Series No. GSG 11, IAEA, Vienna (2018).

16) FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, UNITED NATIONS DEVELOPMENT PROGRAMME, UNITED NATIONS ENVIRONMENT PROGRAMME, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, Remediation Strategy and Process for Areas Affected by Past Activities or Events, IAEA Safety Standards Series No. GSG-15, IAEA, Vienna (2022).

17) INTERNATIONAL ATOMIC ENERGY AGENCY, Monitoring and Surveillance of Radioactive Waste Disposal Facilities, IAEA Safety Standards Series No. SSG-31, IAEA, Vienna (2014).

18) INTERNATIONAL ATOMIC ENERGY AGENCY, WORLD HEALTH ORGANIZATION, Protection of the Public against Exposure Indoors due to Radon and Other Natural Sources of Radiation, IAEA Safety Standards Series No. SSG-32, IAEA, Vienna (2015).

19) INTERNATIONAL ATOMIC ENERGY AGENCY, Management of Residues Containing Naturally Occurring Radioactive Material from Uranium Production and Other Activities, IAEA Safety Standards Series No. SSG-60, IAEA, Vienna (2021).

20) INTERNATIONAL ATOMIC ENERGY AGENCY, Release of Sites from Regulatory Control on Termination of Practices, IAEA Safety Standards Series No. WS-G-5.1, IAEA, Vienna (2006).

21) INTERNATIONAL ATOMIC ENERGY AGENCY, Application of the Concepts of Exclusion, Exemption and Clearance, IAEA Safety Standards Series No. RS-G-1.7, IAEA, Vienna (2004) (under revision, DS499 and DS500).

22) INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental and Source Monitoring for Purposes of Radiation Protection, IAEA Safety Standards Series No. RS-G-1.8, IAEA, Vienna (2005) (under revision, DS505).

23) INTERNATIONAL ATOMIC ENERGY AGENCY, The Fukushima Daiichi Accident, Report by the Director General, IAEA, Vienna (2015).

24) INTERNATIONAL ATOMIC ENERGY AGENCY, Communication and Stakeholder Involvement in Environmental Remediation Projects, IAEA Nuclear Energy Series No. NW-T-3.5, IAEA, Vienna (2014).

25) INTERNATIONAL ATOMIC ENERGY AGENCY, Lessons Learned from Environmental Remediation Programmes, IAEA Nuclear Energy Series No. NW-T-3.6, IAEA, Vienna (2014).

26) INTERNATIONAL ATOMIC ENERGY AGENCY, Policy and Strategies for Environmental Remediation, IAEA Nuclear Energy Series No. NW-G-3.1, IAEA, Vienna (2015).

27) INTERNATIONAL ATOMIC ENERGY AGENCY, Guidelines for Remediation Strategies to Reduce the Radiological Consequences of Environmental Contamination, Technical Reports Series No. 475, IAEA, Vienna (2012).

28) DS519, Protection of Workers against Exposure due to Radon (new Safety Guide).

29) DS526, National Policies and Strategies for the Safety of Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (new Safety Guide).

30) IAEA Nuclear Energy Series No. NW-G-3.2, Determination of Environmental Remediation End Stated (in preparation).

31) IAEA Nuclear Energy Series, The Use of Controls for Contaminated Land Management (DPP2021_03_03_115_46, in preparation).

The Safety Guide will also consider the provisions of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (INFCIRC/546) regarding the safe management of radioactive waste resulting from past practices.

As applicable, it will be necessary to coordinate with the development and revision of other relevant guidance issued in the IAEA safety standards and the IAEA Nuclear Security Series.

The three Sections in the Division of Radiation, Transport and Waste Safety (NSRW) will be consulted in the drafting process. The Decommissioning and Environmental Remediation Section in the Division of Nuclear Fuel Cycle and Waste Technology (NEFW) and the Division of Nuclear Security (NSNS) will also be consulted during drafting.

7. OVERVIEW

The tentative table of contents for the proposed Safety Guide is as follows:

1. Introduction
    - 1.1. Background
    - 1.2. Objective
    - 1.3. Scope
    - 1.4. Structure
2. National framework for long term post-remediation management
    - 2.1. National policy
    - 2.2. National strategy
    - 2.3. Legal and regulatory framework
    - 2.4. Roles and responsibilities
3. Planning post-remediation management
    - 3.1. Considerations for planning post-remediation management
    - 3.2. Application of the graded approach and the principles of justification and optimization
    - 3.3. Considerations for selection of reference levels, end state and end point criteria
    - 3.4. Considerations for safety assessment and environmental impact assessment of the post-remediation phase (exposure scenarios)
    - 3.5. Selecting and designing remedial actions for the long term
    - 3.6. Selection of restrictions and controls
    - 3.7. Release from regulatory control
    - 3.8. Transition to post-remediation and transfer of regulatory responsibility
    - 3.9. Periodic review of post-remediation management
    - 3.10. Radiation protection during post-remediation
4. Post-remediation management activities (active controls)

- 4.1. Monitoring and surveillance of remediated areas
  - 4.1.1. Radiological monitoring
  - 4.1.2. Environmental monitoring
  - 4.1.3. Inspections
  - 4.1.4. Geotechnical surveillance of engineered structures
- 4.2. Maintenance of remediated areas
  - 4.2.1. Preventive maintenance
  - 4.2.2. Corrective maintenance
- 4.3. Operation of facilities (e.g. water treatment plants) in remediated areas
- 4.4. Management of residuals materials generated during post-remediation
- 4.5. Emergency preparedness and response
- 4.6. Unforeseen events at remediated areas

5. Administrative controls (passive controls) for remediated areas
   - 5.1. Land use restrictions
   - 5.2. Resource use restrictions
   - 5.3. Food-stuff restrictions
   - 5.4. Deeds
   - 5.5. Regulations
6. Involvement of interested parties for remediated areas
   - 6.1. Communication and consultation with interested parties
   - 6.2. Role of ‘citizen science’ in building community trust and knowledge
   - 6.3. Policy for dealing with social media issues
   - 6.4. Challenges of multi-generational involvement of interested parties
7. Management system for remediated areas
8. Long term challenges and risks for remediated areas
   - 8.1. Contaminants of concern
   - 8.2. Unforeseen events
   - 8.3. Geohazards, climate change
   - 8.4. New standards or regulations
   - 8.5. Scientific and technological developments
   - 8.6. Uncertainties of knowledge
   - 8.7. Other risks, holistic approach
9. Knowledge management for remediated areas
   - 9.1. Preservation and transfer of records to future generations
   - 9.2. Preservation and transfer of knowledge of the remediation to future generations

10. Funding for post-remediation management
    10.1. Funding mechanisms (current expenditures)
    10.2. Financial assurance (unforeseen expenditures)

References

Annexes

Examples and case-studies of post-remediation management in different Member States (e.g. different types of existing exposure situations, radionuclides, remediation and post-remediation strategies)

Abbreviations

Contributors to drafting and review

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

	A
STEP 1: Preparing a DPP	DONE
STEP 2: Internal review of the DPP (Approval by the Coordination Committee)	Q2/2022
STEP 3: Review of the DPP by the review Committee(s) (Approval by review Committee(s))	Q2/2022
STEP 4: Review of the DPP by the CSS (approval by CSS) or information of the CSS on the DPP	Q4/2022
STEP 5: Preparing the draft publication	Q1/2023
STEP 6: First internal review of the draft publication (Approval by the Coordination Committee)	Q1/2025
STEP 7: First review of the draft publication by the review Committee(s) (Approval for submission to Member States for comments)	Q2/2025
STEP 8: Soliciting comments by Member States	Q4/2025
STEP 9: Addressing comments by Member States	Q1/2026
STEP 10: Second internal review of the draft publication (Approval by the Coordination Committee)	Q2/2026
STEP 11: Second review of the draft publication by the review Committee(s) (Approval of the draft)	Q4/2026
STEP 12: (For Safety Standards) Editing of the draft publication in MTCD and endorsement of the draft publication by the CSS (For nuclear security guidance) DDG's decision on whether additional consultation is needed, establishment by the Publications Committee and editing	Q2/2027
STEP 13: Approval by the Board of Governors (for SF and SR only)	N/A
STEP 14: Target publication date	Q1/2028

9. RESOURCES

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

- Secretariat:
    - 1 Technical Officer – 36 person-weeks
    - 1 administrative assistant – 6 person-weeks

- Member States:
    - 3 Consultancy Meetings (4 consultants x 5 days each)
    - 6 person-week home based assignments
    - 1 Technical Meeting (25 participants x 5 days)

ANNEX: GAP ANALYSIS

IAEA Safety Standards Series No. GSG-15, Remediation Strategy and Process of Remediation of Areas Affected by Past Activities or Events (in publication), provides recommendations on the planning and implementation of remediation programmes, based on a systematic and stepwise approach, that divides the remediation process into five phases: preliminary evaluation; detailed evaluation; planning of remediation; implementation and verification monitoring; and post-remediation management. It is intended to support the implementation of IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, in particular Requirements 47–49 and 52 on existing exposure situations. Safety Guide GSG-15 provides general recommendations on the post-remediation phase and covers the removal of restrictions, record keeping, involvement of interested parties, and monitoring and surveillance programmes.

Specific recommendations are needed on post-remediation management to support the general recommendations provided in GSG-15. For example, regarding the definitions of roles, responsibilities and funding provisions in the national policy and strategy, and in the legal and regulatory framework for the long term post-remediation management of areas affected by past activities or events. Additionally, there is a need for clarification on the process of release of sites from regulatory control and transition to post-remediation management, and for recommendations on the implementation of post-remediation management, including monitoring, surveillance, maintenance and compliance with restrictions on the remediated area, to ensure the remediation remains effective in the long term and the residual risks are compatible with the intended uses of the area. In particular, it is necessary to provide clarification on the definition of institutional controls, and the range of controls that could be implemented in the context of post-remediation management.

The selection of remedial actions will have an impact on the post-remediation management activities and vice versa. Therefore, adequate planning is necessary to optimize activities in the post-remediation management phase and increase resilience to changing factors in the long term that might compromise the effectiveness of remediation. Such factors might include climate change, extreme and unforeseen events, and other evolving aspects, such as social, scientific and technological developments. Additional specific guidance is needed on aspects such as the implementation of management systems and maintaining involvement of, and consultation, with interested parties in the long term.