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Remediation Process for Areas Affected by Past Activities and Accidents

Safety Guide

No. WS-G-3.1



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REMEDIATION PROCESS FOR AREAS AFFECTED BY PAST ACTIVITIES AND ACCIDENTS

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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REMEDIATION PROCESS FOR AREAS AFFECTED BY PAST ACTIVITIES AND ACCIDENTS

SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2007

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FOREWORD

by Mohamed ElBaradei
Director General

The IAEA's Statute authorizes the Agency to establish safety standards to protect health and minimize danger to life and property — standards which the IAEA must use in its own operations, and which a State can apply by means of its regulatory provisions for nuclear and radiation safety. A comprehensive body of safety standards under regular review, together with the IAEA's assistance in their application, has become a key element in a global safety regime.

In the mid-1990s, a major overhaul of the IAEA's safety standards programme was initiated, with a revised oversight committee structure and a systematic approach to updating the entire corpus of standards. The new standards that have resulted are of a high calibre and reflect best practices in Member States. With the assistance of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its safety standards.

Safety standards are only effective, however, if they are properly applied in practice. The IAEA's safety services — which range in scope from engineering safety, operational safety, and radiation, transport and waste safety to regulatory matters and safety culture in organizations — assist Member States in applying the standards and appraise their effectiveness. These safety services enable valuable insights to be shared and I continue to urge all Member States to make use of them.

Regulating nuclear and radiation safety is a national responsibility, and many Member States have decided to adopt the IAEA's safety standards for use in their national regulations. For the Contracting Parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by designers, manufacturers and operators around the world to enhance nuclear and radiation safety in power generation, medicine, industry, agriculture, research and education.

The IAEA takes seriously the enduring challenge for users and regulators everywhere: that of ensuring a high level of safety in the use of nuclear materials and radiation sources around the world. Their continuing utilization for the benefit of humankind must be managed in a safe manner, and the IAEA safety standards are designed to facilitate the achievement of that goal.

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1. INTRODUCTION

BACKGROUND

1.1. A large number of areas that have been contaminated by residual radioactive material as a result of past activities or accidents require intervention¹. These areas may be very large and of specific interest and may call for major commitments of resources in terms of funding and personnel. Some past activities and accidents have led to significant radioactive contamination of areas in many Member States. This contamination may represent a hazard to the general public and the environment. Other areas that were contaminated as a result of past or current practices² are small and can be remediated as part of a larger decommissioning project, if such a project is being prepared, or as a standalone project. Member States have expressed a need for guidance on remediating areas contaminated by past activities and accidents.

1.2. The IAEA Safety Requirements publication on Remediation of Areas Contaminated by Past Activities and Accidents [1] establishes safety requirements for the remediation of areas that require intervention. Guidance on the remediation of smaller areas as part of the decommissioning process for practices is provided in Ref. [2].

OBJECTIVE

1.3. The objective of this Safety Guide is to provide guidance on implementing the requirements for the remediation of areas contaminated by past activities and accidents [1]. It is intended to be used by regulatory bodies, operators and others responsible for remediating sites and, in the case of an accident, contributing to the recovery process.

¹ An intervention is defined as any action intended to reduce or avert exposure or the likelihood of exposure to sources which are not a part of a controlled practice or which are out of control as a consequence of an accident [3].

² A practice is defined as any human activity that introduces additional sources of exposure or exposure pathways or extends exposure to additional people or modifies the network of exposure pathways from existing sources, so as to increase the exposure or the likelihood of exposure of people or the number of people exposed [3].

SCOPE

1.4. The situations dealt with in this Safety Guide are interventions for areas that have been contaminated as a result of human activities and that could cause prolonged radiation exposure. In this context, the term ‘areas’ is used in its broadest sense and can include land, water bodies and industrial sites. These areas may have been contaminated as a result of inadequate practices for radioactive waste management and disposal, accidental radioactive discharges to the environment that did not meet regulatory requirements, nuclear accidents, atomic weapon tests, incidents involving releases of radionuclides by users of radioactive material or past practices that were not adequately controlled. This Safety Guide also applies to radioactive discharges from facilities that were managed in accordance with less stringent requirements than those that are applied today. It could also be relevant in the event of malicious action involving radioactive material. This Safety Guide does not apply to facilities that are currently under regulatory control and that may have had emergencies that have contaminated small areas within the facility.

1.5. This publication provides recommendations for protective and remedial actions that are intended to reduce existing prolonged exposures due to contamination and to avert potential prolonged exposure or the likelihood of such exposure from related contamination. This includes remedial actions such as the removal of the source of exposure, as well as other long term protective actions such as restrictions on consumption of foodstuffs produced in the area and restriction of access to land areas or of land use. It covers other important measures linked to remediation activities, such as the need for monitoring programmes, although these do not contribute directly to the reduction of exposure.

1.6. In certain situations, non-radiological hazards may be present together with the radioactive contamination. Although the non-radiological hazards should be assessed in conjunction with radiological hazards to find an optimal remediation strategy, the scope of this publication does not include the manner in which this can be accomplished.

1.7. In the context of intervention situations, the term ‘remediation’ has a meaning that is similar to rehabilitation, reclamation and cleanup. It does not include decommissioning, as decommissioning refers to the full range of activities leading to the termination of an authorized activity.

STRUCTURE

1.8. Section 2 of this Safety Guide discusses the regulatory framework and responsibilities. It also provides guidance concerning the prioritization of remediation at the national level. Section 3 presents an overview of the general remediation process and the first steps in the process. Section 4 provides guidance on planning for remediation, while Section 5 covers the implementation of remediation and includes guidance on such activities as staffing and training, organization and administrative control, waste management and radiation protection. Section 6 deals with post-remediation issues, including the setting and removal of restrictions.

2. REGULATORY INFRASTRUCTURE AND RESPONSIBILITIES

GENERAL

2.1. Many factors should be considered when ensuring the overall protection of workers, the public and the environment during the remediation process. In particular, several key administrative and technical issues should be addressed before any remediation is considered. First, the regulatory framework of the Member State should have adequate provisions for a governmental authority to oversee the process. The responsibilities and powers of the regulatory bodies should be clearly established, and the remediation process should be designed and implemented in a systematic way, with each step and all decisions clearly documented. Finally, the criteria should be established for making decisions on whether remediation is required, and to what extent. General requirements for the legal and governmental infrastructure are established in Ref. [4] and are not repeated in this Safety Guide.

REGULATORY FRAMEWORK

2.2. Provisions are required within the regulatory infrastructure for the regulatory body to review and approve proposed remediation plans that are submitted by the organization responsible for implementing remedial measures (Ref. [1], para. 5.5). The framework is required to include provisions

for the granting of licences or other authorizations as well as the imposition of fines or other penalties that may be necessary during the remediation process (Ref. [1], para. 4.9). A mechanism should be put in place that will ensure cost recovery and funding for the regulatory body.

2.3. The regulatory infrastructure should provide for the regulatory body to determine when a site or group of sites will require remediation. This is essential to minimize the detrimental effects of the prolonged exposure associated with some sites.

2.4. The regulatory framework should provide the basis for establishing restrictions that may be placed upon the use of or access to areas, before, during and, if necessary, after remediation.

2.5. “The legal framework shall provide for appropriate record keeping” of information (Ref. [1], para. 4.7). This is particularly important where restrictions are imposed on access to areas or on the activities that may be conducted in these areas. A complete set of records should be available to aid any subsequent actions necessary for the removal of any restrictions imposed. Within the regulatory framework, a wide range of interested parties should be consulted and kept informed of the site specific strategy and activities.

2.6. The legal framework is required to ensure that “adequate funding mechanisms are available” for providing the necessary resources when needed, even if responsible parties are unable to meet their liabilities (Ref. [1], para. 4.4).

2.7. In the absence of specific regulations for remediation, the process should be undertaken on a site specific basis under existing regulations for each activity associated with the remediation. In such a situation, the organization responsible for the remediation should consult, and obtain approval from, the regulatory body for compliance with the existing regulations.

RESPONSIBILITIES

2.8. When a contaminated area has been identified, remediation of that area should be the responsibility of the area’s owner or the operator (defined as the responsible party) that caused the contamination, or of the legally responsible successor organization. Often, however, such parties can no longer be located, or they cannot fund the necessary remediation activities, or the contamination

was the result of an accident or of an activity that was supported by the government. Since the actual remediation of a contaminated area may involve several entities that include individuals who may be unfamiliar with radiation protection principles, the roles and responsibilities of the different parties involved in the remediation process should be clearly defined. In particular, those persons or organizations responsible for providing adequate human resources, equipment and supporting infrastructure and the necessary funding for accomplishing the remediation should be clearly identified to the regulatory body.

2.9. To discharge its responsibilities as defined in Ref. [4], the regulatory body should have the appropriate resources, including properly trained and experienced staff, facilities and financial commitments. Its responsibilities should include:

- (a) Identifying and quantifying potentially contaminated areas and the associated responsible parties;
- (b) Prioritizing contaminated areas;
- (c) Establishing remediation criteria;
- (d) Specifying the time when remediation activities should be initiated;
- (e) Reviewing and approving the selected optimized remediation strategy, remediation plans and supporting documents relating to the performance of remediation activities associated with a contaminated site, in terms of radiological, non-radiological and conventional safety;
- (f) Monitoring the remediation activities during implementation;
- (g) Verifying that all final conditions have been met prior to terminating regulatory control over the area;
- (h) Formally terminating regulatory control over the area;
- (i) Reviewing and approving any restrictions or institutional controls if the area is released for restricted use;
- (j) Ensuring public participation in all activities associated with the remediation process;
- (k) Liaising with other regulatory organizations that have responsibilities for non-radiological hazards in the same area.

2.10. The overall responsibility for the planning and implementation of the remediation activities should remain with the responsible party, even when contractors are used to perform specific tasks or functions. “The identified responsible parties for the remediation of an area shall be responsible for all aspects of safety until the completion of the remediation effort” (Ref. [1], para. 4.10). The responsible party should develop a public information

programme to provide regular information throughout the remediation project and to allow public participation in the planning and implementation process. The responsible party should also:

- (a) Retain the necessary resources, expertise and knowledge for remediation;
- (b) Keep records and documentation relevant to the history, operation and remediation process so that such information can be transferred to any supporting or successor owner or operating organization;
- (c) Prepare a remediation plan and all supporting documentation for review and approval by the regulatory body;
- (d) Ensure the safety of workers and the public and protection of the environment during the safe implementation of the approved remediation plan;
- (e) Report to the regulatory body on a scheduled basis any safety related information as required by the terms of the remediation plan;
- (f) Report to the regulatory body any unusual incidents that may occur during the remediation process;
- (g) Ensure the maintenance of records and documentation following the completion of remediation for a period of time as specified by the regulatory body.

PRIORITIZATION OF CONTAMINATED OR POTENTIALLY CONTAMINATED AREAS

2.11. To implement the requirement for a national remediation strategy, areas that have been identified as contaminated should be prioritized. Following the initial characterization of each area, an inventory of contaminated areas should be prepared, which includes their locations, the types and properties of the contaminants, the size and environmental characteristics of the areas, the populations actually or potentially exposed and any other relevant factors.

2.12. The inventory of contaminated areas should then be prioritized in accordance with the level of risk to human health and the environment. Other factors, such as socioeconomic impacts, availability of funds, availability of remediation techniques, availability of scientific data and potential effects on neighbouring States, may also have a strong influence in determining the priorities for remediation. If the parties responsible for some of the identified sites are ready to perform the remediation activities at their own cost, the remediation of these sites should not be postponed awaiting the national remediation strategy prioritization.

2.13. The identification and prioritization of contaminated areas should be aided by the involvement of government agencies other than the regulatory body and by private organizations. The national strategy should provide for their input into the process.

2.14. To assist in determining priorities, the regulatory body should use reference levels (see paras 3.18–3.23 of this Safety Guide and Ref. [5]) on the basis of an a priori assessment of situations that could occur. The priorities may also be established by comparison with other similar areas where exposures or activity concentrations are considered to be acceptable. Documentation of the process used for the prioritization of the list should be maintained. As new areas are identified, they should be added to the list and the list should be prioritized once again; however, reprioritization should not prevent remediation from progressing.

3. OVERVIEW OF THE REMEDIATION PROCESS AND INITIAL DECISION MAKING

GENERAL

3.1. The overall remediation process shown in Fig. 1 involves four main activities: (a) initial site characterization and selection of remediation criteria; (b) identification of remediation options and their optimization, followed by subsequent development and approval of the remediation plan; (c) implementation of the remediation plan; and (d) post-remediation management. Following the completion of each of these main activities, a decision should be made about whether to release the area or part of the area for either restricted or unrestricted use, or to proceed to the next activity. The differences in implementation for specific areas will be in the degree of detail and complexity of the activities undertaken in each step in the process. An iterative approach based on the potential risks should be used in this process.

OVERALL APPROACH IN THE REMEDIATION PROCESS

3.2. Planning for remediation should begin once the regulatory body has identified a contaminated site or in accordance with the prioritization list. The