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Decommissioning of Facilities

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CONTENTS

1. INTRODUCTION

BACKGROUND

1.1. The terms ‘siting’, ‘design’, ‘construction’, ‘commissioning’, ‘operation’, and ‘decommissioning’ are normally used to delineate the six major stages of the lifetime of an authorized facility and of the associated licensing process. The term ‘decommissioning’ refers to the administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility (except for the part of a disposal facility in which the radioactive waste is emplaced, for which the term ‘closure’ instead of ‘decommissioning’ is used). Aspects of decommissioning have to be considered throughout the other five major stages.

1.2. Aspects of decommissioning typically include planning for decommissioning, conducting decommissioning actions and terminating the authorization for decommissioning. There may be a period of transition between permanent shutdown[1] and the time when authorization to begin decommissioning actions is granted.

1.3. In this publication, ‘facility’ means buildings and their associated land and equipment, in which radioactive material was or still is produced, processed, used, handled or stored on a scale with such a degree of hazard and risks that consideration of protection and safety is required. ‘Land’ includes the surface, subsurface soil horizons and any surface or subsurface water or aquifers potentially affected by the radioactive material.

1.4. Decommissioning is performed using a graded approach to achieve a progressive and systematic reduction in radiological hazards. Decommissioning is undertaken on the basis of planning and assessment to ensure the protection and safety of workers and the public and the protection of the environment.

1.5. ‘Decommissioning actions’ are the procedures, processes and work activities (for example decontamination and/or removal of structures, systems and components) as described in the approved final decommissioning plan. Decommissioning actions are considered completed when the approved end state of the facility has been reached. Subject to national legal and regulatory requirements, this end state is a result of conducting decontamination and/or dismantling, waste management and cleanup, leading to the release of the facility from regulatory control with or without restrictions on its future use.

[1] The term ‘permanent shutdown’, as used in this publication, is when the facility has ceased operation and will not be restarted.

1.6. Planning for decommissioning begins at the design stage and continues throughout the lifetime of the facility. It includes the preparation of an initial decommissioning plan, collection of relevant information and data to facilitate future decommissioning, selection of a decommissioning strategy, radiological characterization of the facility, preparation of a final decommissioning plan, estimation of costs and identification of the provision of financial resources for the decommissioning project, submission of the plan to the regulatory body for review and approval and any activities for public consultation in accordance with national requirements.

1.7. Conducting decommissioning actions includes management of the project, implementation of the approved final decommissioning plan, management of radioactive waste and non-radioactive waste, and demonstration that the facility meets the end state criteria specified in the final decommissioning plan. These activities are performed by or under the responsibility of the licensee. In parallel, oversight activities are conducted by the regulatory body.

1.8. Termination of the authorization for decommissioning involves the demonstration of compliance with the conditions of the authorization for decommissioning of the facility (in particular, meeting the end state criteria), withdrawal of this authorization for the facility, and release of the facility from regulatory control for restricted or unrestricted use in the future.

1.9. Strategies for decommissioning that have been adopted or are being considered by States include immediate dismantling and deferred dismantling. In principle, these two possible decommissioning strategies are applicable for all facilities.

- *Immediate dismantling:* In this case, decommissioning actions begin shortly after the permanent shutdown. Equipment, structures, systems and components of a facility containing radioactive material are removed and/or decontaminated to a level that permits the facility to be released from regulatory control for unrestricted use, or released with restrictions on its future use.

- *Deferred dismantling:* In this case, after removal of the nuclear fuel from the facility (for nuclear installations), all or part of a facility containing radioactive material is either processed or placed in such a condition that it can be put in safe storage and the facility maintained until it is subsequently decontaminated and/or dismantled. Deferred dismantling may involve early dismantling of some parts of the facility and early processing of some radioactive material and its removal from the facility, as preparatory steps for safe storage of the remaining parts of the facility.

1.10. A combination of these two strategies may be considered practicable on the basis of safety requirements or environmental requirements, technical considerations and local conditions such as the intended future use of the site, or financial considerations. Entombment, in which all or part of the

facility is encased in a structurally long lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances, (e.g. following a severe accident).

1.11. This publication establishes internationally agreed requirements for decommissioning of facilities on the basis of the fundamental safety objective and fundamental safety principles established in the Safety Fundamentals [1].

1.12. Unless otherwise defined, the terms used in this publication have the meanings ascribed to them in the IAEA Safety Glossary, 2007 Edition [2].

1.13. This publication supersedes Decommissioning of Facilities Using Radioactive Material, IAEA Safety Standards Series No. WS-R-5, issued in 2006[2].

OBJECTIVE

1.14. The objective of this publication is to establish the general safety requirements to be met during planning for decommissioning, during conduct of decommissioning actions and during termination of authorization for decommissioning.

SCOPE

1.15. This publication establishes the safety requirements for all aspects of decommissioning from the siting and design of a facility to the termination of the authorization for decommissioning.

1.16. This publication applies to nuclear power plants, research reactors, other nuclear fuel cycle facilities, including predisposal waste management facilities, facilities for processing naturally occurring radioactive material (NORM), former military sites, and relevant medical facilities, industrial facilities and research facilities.

1.17. It does not apply to radioactive waste disposal facilities or disposal facilities for NORM or for waste from mining and mineral processing. Requirements for the closure of such facilities are established in Ref. [3]. However, requirements for the decommissioning of supporting buildings and services of such facilities are established in the present publication.

1.18. This publication does not address the remediation of areas contaminated by residual radioactive material arising from past activities that (a) were never subject to regulatory control or (b)

[2]INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities Using Radioactive Material, IAEA Safety Standards Series No.WS-R-5, IAEA, Vienna (2006).

were subject to regulatory control in a manner that is not in accordance with the relevant IAEA safety standards and national regulations. It also does not address the remediation of areas affected by a nuclear or radiological emergency, after the emergency has been declared to be over. However, many of the requirements established in this publication can also be applied to decommissioning after an accident has occurred or a situation has arisen that has resulted in serious damage to, or the contamination of, a facility, or simply after the premature shutdown of a facility. The requirements for the remediation of such areas are established in Ref. [4].

1.19. The definition of decommissioning (see para. 1.1) makes it clear that decommissioning is concerned with 'facilities', i.e. buildings, including their associated land and equipment. There may be areas of land that have become contaminated during operation of a facility. The clean up of these areas would also be included as part of decommissioning.

1.20. The management of fresh nuclear fuel and spent nuclear fuel and radioactive waste generated during the operational phase of a facility are not usually considered part of decommissioning. These are addressed as part of operation of the facility and are outside the scope of this publication. However, management of waste from decommissioning is within the scope of this publication.

1.21. This publication addresses the radiological hazards resulting from decommissioning. Non-radiological hazards, such as industrial hazards or hazards due to chemical waste, can be significant during decommissioning. Such hazards require due consideration in the planning and implementation process, in the safety assessments and environmental assessments, and in the estimation of costs and the provision of financial resources for the decommissioning project. However, these issues are outside the scope of this publication and are not explicitly addressed here.

1.22. Security aspects have to be considered during decommissioning, but are outside the scope of this publication. The IAEA issues recommendations on nuclear security in the IAEA Nuclear Security Series [5]. Particular attention should be given to the requirements pertaining to interfaces of safety with nuclear security and governmental responsibilities pertaining to such [6].

STRUCTURE

1.23. Section 2 establishes the requirements for the protection and safety of workers and the public and for the protection of the environment. The responsibilities of the major parties associated with decommissioning are established in Section 3. Section 4 establishes the requirements for the management of decommissioning and Section 5 establishes the requirements for selecting a decommissioning strategy. Section 6 establishes the requirements for the financing of decommissioning and Section 7 establishes the requirements for the planning for decommissioning that is done during the facility's lifetime. Section 8 establishes the requirements to be followed when conducting decommissioning actions. Section 9 establishes the requirements for determining when

decommissioning has been completed, including the requirements for surveys to demonstrate the completion of decommissioning actions and the termination of authorization for decommissioning.

2. PROTECTION OF PEOPLE AND PROTECTION OF THE ENVIRONMENT

Requirement 1: Optimization of protection and safety

Exposure during decommissioning shall be considered to be planned exposure situation and the relevant requirements of the Basic Safety Standards [4] shall be applied accordingly during decommissioning.

2.1. The relevant dose limits for the exposure of workers and members of the public shall be applied during decommissioning [4]. Radiation protection of persons who are exposed as a result of decommissioning actions shall be optimized with due regard to the relevant dose constraints.

2.2. In addition to provisions to protect against exposure during planned activities, provision shall be made during decommissioning for protection against, and for reduction of, exposure due to an incident. However, if the incident or the particular situation is of such a nature as to warrant remediation or to require confinement of releases of radioactive material under emergency conditions, other IAEA safety standards apply [4, 7].

2.3. National environmental protection regulations and the requirements of Ref. [4] addressing protection of the environment shall be complied with during decommissioning and beyond if a facility is released from regulatory control with restrictions on its future use.

Requirement 2: Graded approach

A graded approach shall be applied in all aspects of decommissioning in determining the scope and level of detail for any particular facility, consistent with the magnitude of the possible radiation risks arising from the decommissioning.

2.4. The type of information and the level of detail in the decommissioning plans and supporting documents, including the safety assessments, shall be commensurate with the type, scale, complexity, status and stage in the lifetime of the facility and with the hazards associated with the decommissioning of the facility [4, 8].

2.5. The conduct and regulatory oversight of decommissioning actions shall be applied in a manner that is commensurate with the hazards and risks associated with the decommissioning of the facility.

Requirement 3: Assessment of safety

Safety shall be assessed for all facilities for which decommissioning is planned and all facilities undergoing decommissioning.

2.6. The final decommissioning plan shall be supported by a safety assessment addressing the planned decommissioning actions and incidents, including accidents that may occur or situations that may arise during decommissioning.

2.7. The supporting safety assessment shall be prepared by the licensee in accordance with Ref. [8].

3. RESPONSIBILITIES ASSOCIATED WITH DECOMMISSIONING

3.1. Requirements for general responsibilities within the governmental, legal and regulatory framework with respect to all matters concerning facilities and activities are established in Ref. [6]. These requirements apply in establishing the appropriate national framework and in allocating responsibilities for decommissioning.

Requirement 4: Responsibilities of the government

The government shall establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning, including management of the resulting radioactive waste, can be planned and carried out safely. This framework shall include a clear allocation of responsibilities, provision of independent regulatory functions and requirements in respect of financial mechanisms for decommissioning.

3.2 The responsibilities of the government shall include:

- Establishing a national policy for management of radioactive waste, including radioactive waste generated during decommissioning;
- Establishing and maintaining the legal, technical and financial responsibilities for organizations involved in decommissioning, including responsibilities for granting the authorization to conduct decommissioning and for the management of the resulting radioactive waste;
- Ensuring that the necessary scientific and technical expertise is available both for the licensee and for the support of regulatory review and other independent national review functions;

– Establishing a mechanism to ensure that adequate financial resources are available when necessary for safe decommissioning and for the management of the resulting radioactive waste.

Requirement 5: Responsibilities of the regulatory body

The regulatory body shall regulate all aspects of decommissioning throughout all stages of the facility's lifetime, from initial planning of decommissioning during the siting and design of the facility, to the completion of decommissioning actions and the termination of authorization for decommissioning. The regulatory body shall establish the safety requirements for decommissioning, including requirements for management of the resulting radioactive waste, and shall adopt associated regulations and guides. The regulatory body shall also take actions to ensure that the regulatory requirements are met.

3.3. The responsibilities of the regulatory body shall include:

– Establishing criteria and the timeframe for the process of authorization for decommissioning;

– Establishing requirements for conducting radiological surveys for determining levels of contamination at the facility;

– Establishing requirements relating to the criteria for safety and protection of workers, public and the environment during decommissioning of facilities, including criteria for clearance of material from regulatory control in accordance with national policy;

– Establishing requirements and criteria for termination of authorization for decommissioning and especially when facilities/sites are released with restrictions on their future use;

– Establishing requirements for financial assurance for decommissioning and for a mechanism to ensure that adequate resources will be available when necessary for safe decommissioning, in the case where the government has delegated this responsibility to the regulatory body;

– Establishing requirements for planning of decommissioning, including:

  o Specification of the typical content of decommissioning plans and supporting documents for review or approval;

- Establishment of the review process for decommissioning plans and supporting documents (that are prescribed in national regulations) and the timeframe for such reviews;

- Review of the initial decommissioning plan and updates, review and approval of the final decommissioning plan and supporting documents, and review and approval of updates after the final decommissioning plan has been approved;

– Providing interested parties with an opportunity to provide comments on the final decommissioning plan and supporting documents before its approval, on the basis of national regulations;

– Inspecting and reviewing decommissioning actions and taking enforcement actions in the case of non-compliance with the national legal and regulatory framework or with the authorization or licence conditions and safety requirements established by the regulatory body;

– Promoting a safety culture in order to encourage a questioning and learning attitude towards safety and to discourage complacency [4, 9];

– Establishing requirements for the collection and retention of records and reports relevant to decommissioning, and for preserving information about the activities that have been conducted at the site;

– Evaluating the end state of a decommissioned facility and deciding whether the conditions have been met to allow the termination of authorization for decommissioning;

– Terminating the authorization for decommissioning when the licensee has demonstrated that the approved end state has been met.

Requirement 6: Responsibilities of the licensee

The licensee shall plan for decommissioning and shall conduct the decommissioning actions in compliance with the authorization for decommissioning and with requirements derived from the national legal and regulatory framework. The licensee shall be responsible for all aspects of safety, radiation protection and environmental protection during decommissioning.

3.4. The responsibilities of the licensee shall include:

– Selecting a decommissioning strategy as the basis for preparing and maintaining decommissioning plans (the initial decommissioning plan and the final decommissioning plan) throughout the lifetime of the facility;

– Preparing and submitting an initial decommissioning plan and its updates for review by the regulatory body;

– Establishing and implementing an integrated management system [9]; if the licensee changes during the lifetime of the facility, procedures shall be put in place to ensure transfer of responsibilities for decommissioning to the new licensee;

– Fostering a safety culture in order to encourage a questioning and learning attitude towards safety and to discourage complacency [4, 9];

– Estimating the cost of decommissioning actions and providing financial assurances and resources to cover the costs associated with safe decommissioning, including management of the resulting radioactive waste;

– Notifying the regulatory body (or the government, if so required) prior to permanent shutdown of the facility;

– Submitting a final decommissioning plan and supporting documents for review and approval by the regulatory body, in accordance with national regulations, in order to obtain an authorization to conduct decommissioning;

– Managing the decommissioning project and conducting decommissioning actions or ensuring oversight of the actions conducted by contractors;

– Managing the remaining operational waste from the facility and all waste from decommissioning;

– Ensuring that the facility is maintained in a safe configuration during the period of transition following permanent shutdown and until the approval of the final decommissioning plan;

– Performing safety assessments and environmental impact assessments in support of decommissioning actions;

– Preparing and implementing appropriate safety procedures, including emergency plans;

– Ensuring that properly trained, qualified and competent staff are available for the decommissioning project;

– Performing radiological surveys in support of decommissioning;

– Verifying that end state criteria have been met by performing a final survey;

– Keeping and retaining records and submitting reports as required by the regulatory body.

4. MANAGEMENT OF DECOMMISSIONING

Requirement 7: Integrated management system

The licensee shall ensure that its integrated management system [9] covers all aspects of decommissioning.

4.1. An integrated management system shall provide a single framework for the arrangements and processes necessary to address all the goals of the operating organization [9], including goals relevant to decommissioning. These goals shall include safety, health, security, environmental, quality and economic elements.

4.2. The integrated management system shall enable the planning and implementation of decommissioning actions with the prime goal of ensuring that decommissioning will be conducted safely.

4.3. The prime responsibility for safety shall remain with the licensee [1]. The licensee can delegate the performance of defined tasks to contractors and the integrated management system shall make provisions to ensure that the work of contractors is appropriately specified, controlled and is conducted safely.

4.4. Individuals performing decommissioning actions shall have the necessary skills, expertise and training to perform decommissioning safely. Provisions shall be made to ensure that the institutional knowledge about the facility is obtained and made accessible and, as far as possible, that key staff from the facility are retained.

4.5. All individuals performing decommissioning actions shall have the responsibility to inform management of any concerns about safety. The management also shall ensure that processes are put in place to grant authority and support to such individuals if they decide to suspend decommissioning actions for safety reasons.

4.6. Decommissioning shall be controlled through the use of written procedures. Such procedures shall be subject to review and approval by those parts of licensee responsible for ensuring safety. A methodology for issuing, modifying and terminating work procedures shall be established.

4.7. If the licensee changes during the lifetime of the facility, procedures shall be put in place to ensure proper transfer of responsibility for decommissioning to the new licensee.

5. DECOMMISSIONING STRATEGY

Requirement 8: Selecting a decommissioning strategy

The licensee shall select a decommissioning strategy, which will form the basis for the planning for decommissioning. The strategy shall be consistent with the national policy on management of radioactive waste.

5.1. The preferred decommissioning strategy shall be immediate dismantling. However, there may be situations in which immediate dismantling is not a practicable strategy when all relevant factors are considered.

5.2. The selection of a decommissioning strategy shall be justified by the licensee.

5.3. The licensee shall demonstrate that, for the strategy selected, the facility will be maintained in a safe configuration at all times and will reach the specified decommissioning end state, and that no undue burdens will be imposed on future generations.

5.4. If the shutdown of a facility is sudden, the decommissioning strategy shall be reviewed on the basis of the situation that initiated the sudden shutdown to determine whether revision of the strategy is required. If shutdown is caused by an accident, the facility shall be brought to a safe configuration before an approved final decommissioning plan is implemented.

5.5. For sites with more than one facility, a site strategy for decommissioning shall be developed to ensure that interdependences between the facilities are taken into account in the planning for individual facilities that will lead to final decommissioning plans for each facility (e.g. by means of release of parts of the site from regulatory control, if justified).

6. FINANCING

Requirement 9: Financing of decommissioning

Responsibilities in respect of financial provisions for decommissioning shall be set out in national legislation. These provisions shall include establishing a mechanism to provide adequate

financial resources and ensure that they are available when needed to ensure safe decommissioning.

6.1. Adequate financial resources to cover the costs associated with safe decommissioning, including management of the resulting waste, shall be available when necessary.

6.2. The cost estimate for decommissioning shall be updated on the basis of the periodic update of the initial decommissioning plan or on the basis of the final decommissioning plan. The mechanism used to provide financial assurance shall be consistent with the cost estimate for the facilityand shall be changed if necessary.

6.3. If financial assurance for the decommissioning of an existing facility has not yet been obtained, adequate financial resources shall be put in place as soon as possible. Approval of a renewal or extension of the authorization for operation of the facility shall include provisions for financial assurance.

6.4. In the event of a sudden shutdown of the facility, provisions shall be put in place to enable use of the financial resources for decommissioning when they are needed.

6.5. If the decommissioned facility is to be released with restrictions on its future use, financial assurances shall be such that financial resources are available for monitoring, surveillance and control of the facility throughout the necessary time period.

7. PLANNING OF DECOMMISSIONING DURING THE LIFETIME OF THE FACILITY

Requirement 10: Planning of decommissioning

The licensee shall prepare a decommissioning plan and maintain it throughout the lifetime of the facility, according to the requirements of the regulatory body, in order to show that decommissioning can be accomplished safely to meet the defined end state.

7.1. The regulatory body shall ensure that the licensee takes decommissioning into account in the siting, design, construction, commissioning and operation of the facility, including by means of features to facilitate decommissioning, maintenance of records of the facility, and consideration of physical and procedural methods to limit contamination and/or activation.

7.2. At the siting stage, a background survey of the site, including obtaining information on radiological conditions, shall be performed prior to the construction of a new facility and the baseline data shall be updated prior to its commissioning. This information shall be used to determine

background radiological conditions. For those facilities for which no such background survey has been made in the past, data from analogous and undisturbed areas with similar characteristics shall be used instead of pre-operational baseline data.

7.3. For a new facility, planning of decommissioning shall begin early in the design stage and shall continue through to termination of the authorization for decommissioning.

7.4. The licensee shall prepare and submit to the regulatory body an initial decommissioning plan together with the application for authorization to operate the facility. This initial decommissioning plan shall be required in order to identify decommissioning options, demonstrate the feasibility of decommissioning, to ensure that sufficient financial resources will be available for decommissioning, and to identify categories and estimate quantities of waste that will be generated during decommissioning.

7.5. The decommissioning plan shall be updated by the licensee and shall be reviewed by the regulatory body periodically (typically every 5 years or as prescribed by the regulatory body); or when specific circumstances warrant, such as if changes in an operational process lead to significant changes to the plan. The decommissioning plan shall be updated as necessary in the light of relevant operational experience gained, available lessons learned from the decommissioning of similar facilities, new or revised safety requirements, or technological developments relevant to the selected decommissioning strategy. If an accident occurs or a situation arises with consequences relevant for decommissioning, the decommissioning plan shall be updated by the licensee as soon as possible and shall be reviewed by the regulatory body.

7.6. For existing facilities where there is no decommissioning plan, a suitable plan for decommissioning shall be prepared by the licensee as soon as possible. The plan shall be periodically reviewed and updated.

7.7. Appropriate records and reports that are relevant to decommissioning (e.g. records and reports of events) shall be retained by the licensee throughout the lifetime of the facility. The design of the facility, modifications to the facility and the facility's operating history shall be identified and shall be considered in preparing the decommissioning plans. If permanent shutdown takes place before a final decommissioning plan is prepared, such plan shall be prepared as soon as possible and adequate arrangements shall be made to ensure the safety of the facility until approval of the final decommissioning plan.

7.8. Between the permanent shutdown of operations at the facility and approval of the final decommissioning plan (Requirement 11), there may be a period of transition. During this transition period, the authorization for operation of the facility shall remain in place unless the regulatory body has approved modifications of the authorization on the basis of a reduction in the hazards associated

with the facility. During this period, some preparatory actions for decommissioning can be performed in accordance with the authorization for operation of the facility or a modified authorization.

Requirement 11: Final decommissioning plan

Prior to the conduct of decommissioning actions, a final decommissioning plan[3] shall be prepared and shall be submitted to the regulatory body for approval.

7.9 The licensee shall inform the regulatory body (or the government, if so required) prior to shutting down a facility permanently. If a facility is permanently shut down and/or is no longer used for its intended purpose, a final decommissioning plan shall be submitted to the regulatory body for approval within a period agreed with the regulatory body (typically within 2-5 years of permanent shutdown).

7.10 The final decommissioning plan and supporting documents shall include the following: the selected decommissioning strategy; the schedule, type and sequence of decommissioning actions; the waste management strategy applied, including clearance, the proposed end state and how the licensee will demonstrate that the end state has been achieved; the storage and disposal of the decommissioning waste; the timeframe for decommissioning; and details of the financing for the completion of decommissioning.

7.11 Large and complex decommissioning projects may benefit from having decommissioning actions divided into several phases. All phases necessary to reach the end state shall be described in the final decommissioning plan and supporting documents. Updates of the final decommissioning plan shall include additional information for subsequent phases.

7.12 If the final decommissioning plan or updates to it include new technologies and concepts for decommissioning actions, the licensee shall demonstrate prior to their use that the use of such methods is safe and can effectively achieve the desired result.

7.13 During the preparation and updating of the final decommissioning plan, the extent and type of radioactive material at the facility (e.g. activated and contaminated structures and components) shall be determined by means of a detailed characterization survey and on the basis of records collected during the operational period. If contamination or radioactive waste from operations remains at the facility (including in subsurface soils and groundwater), such radioactive material shall be included in

[3] The final decommissioning plan is that version of the decommissioning plan submitted for approval to the regulatory body prior to implementation of the plan. During implementation of this final plan revisions or amendments may subsequently be needed as the activity progresses.

the characterization survey. Additional characterization of the site for the purpose of evaluating and preventing the potential migration of radionuclides shall be considered.

7.14 If deferred dismantling has been selected as a decommissioning strategy, the licensee shall demonstrate in the final decommissioning plan and supporting documents that such an option will be implemented safely. The availability of adequate financial resources to ensure the facility is maintained in a safe condition during the deferral period and for subsequent decontamination and/or dismantling shall be demonstrated.

7.15 Updates of the final decommissioning plan shall be made as necessary in the light of experience gained in decommissioning, new or revised safety requirements, or new or revised national regulations. Updates of the final decommissioning plan by the licensee shall be subject to review and, if warranted, approval by the regulatory body.

7.16 Interested parties shall be provided with an opportunity to examine the final decommissioning plan and, as appropriate and subject to national regulations, supporting documents, and to provide comments prior to its approval.

8. CONDUCT OF DECOMMISSIONING ACTIONS

Requirement 12: Conduct of decommissioning actions

The licensee shall implement the final decommissioning plan, including management of radioactive waste, in compliance with national regulations.

8.1. The licensee shall implement the final decommissioning plan once the regulatory body has approved it.

8.2. In the case of deferred dismantling, the licensee shall ensure that the facility is maintained in a safe configuration so that subsequent decontamination and/or dismantling can be performed. An adequate programme for maintenance, monitoring and surveillance, which shall be subject to approval by the regulatory body, shall be developed to ensure safety throughout the period of deferral.

8.3. In accordance with the final decommissioning plan, decommissioning techniques shall be selected such that the protection of workers, the public and the environment are optimized, the generation of waste is minimized, and the potential negative impact on storage and disposal of waste is minimized (e.g. by avoiding the use of decontamination techniques that may result in increased mobility of the radionuclides in the waste). As decommissioning actions progress, such as decontamination, cutting and handling of large components, new hazards may arise. The impact of

these actions on safety shall be assessed and managed so that the potential consequences of such new hazards are prevented and/or detected, and mitigated.

8.4. During decommissioning, the licensee shall keep updated the list of structures, systems and components important for safety. Such structures, systems and components can progressively be declassified and dismantled as the decommissioning progresses, provided that the facility's inspection and maintenance programme is updated accordingly.

8.5. The regulatory body shall make arrangements for and shall implement the inspection and review of the decommissioning actions to ensure that they are being carried out in accordance with the final decommissioning plan and the authorization to conduct decommissioning and with other requirements for which the regulatory body has responsibility for oversight. If safety requirements and the conditions for authorization to conduct decommissioning are not met, the regulatory body shall take appropriate enforcement actions.

Requirement 13: Emergency response arrangements

Emergency response arrangements, commensurate with the hazards, shall be established and maintained and events significant to safety shall be reported to the regulatory body in a timely manner.

8.6. The requirements for preparedness for and response to a nuclear or radiological emergency are established in Ref. [7].

Requirement 14: Radioactive waste management

Radioactive waste shall be managed for all waste streams.

8.7. Radioactive waste arising from operational activities that remains at the facility and radioactive waste that is generated during decommissioning shall be disposed of properly [3]. If disposal capacity is not available, radioactive waste shall be stored safely in accordance with the relevant requirements [10].

8.8. Prior to starting decommissioning, the licensee shall ensure the availability of adequate processing and storage capabilities and transport packages for the radioactive waste.

8.9. The licensee shall ensure traceability for all waste generated during decommissioning. The licensee shall maintain up-to-date records of the waste generated, stored in the facility, or transferred to another authorized facility, specifying its quantities, characteristics, treatment methods and destination.

8.10. If operational radioactive waste or nuclear fuel is present in the facility after its permanent shutdown, such material shall be removed prior to conduct of decommissioning actions and shall be transported to an authorized facility in compliance with the applicable transport regulations [11]. In case such removal is not possible during the period of transition between permanent shutdown and the granting of the authorization for decommissioning, the approved final decommissioning plan shall address the removal of these materials as part of decommissioning (during initial phases of immediate dismantling or during the preparatory phase for safe storage). In both cases, the management of such material shall be carried out in accordance with the relevant requirements [10].

9. COMPLETION OF DECOMMISSIONING ACTIONS AND TERMINATION OF AUTHORIZATION FOR DECOMMISSIONING

Requirement 15: Completion of decommissioning actions and termination of authorization for decommissioning

On the completion of decommissioning actions, the licensee shall demonstrate that the end state criteria as specified in the final decommissioning plan and any additional regulatory requirements have been met. The regulatory body shall verify the compliance with the end state criteria and shall decide on termination of the authorization for decommissioning.

9.1. A final decommissioning report shall be prepared by the licensee to demonstrate that the end state of the facility as specified in the approved final decommissioning plan has been reached. This report shall be submitted to the regulatory body for review and approval.

9.2. The regulatory body shall review the final decommissioning report and shall evaluate the end state to ensure that all regulatory requirements and end state criteria, as specified in the final decommissioning plan and in the authorization for decommissioning, have been met. On the basis of this review and evaluation, the regulatory body shall decide on the termination of the authorization for decommissioning and on the release of facility/site from regulatory control.

9.3. If the approved decommissioning end state is release from regulatory control with restrictions on the future use of the remaining structures, appropriate controls and programmes for monitoring and surveillance shall be established and maintained to ensure safety and optimization of protection of the public and the environment. These controls shall be subject to approval by the regulatory body. Responsibility for implementing and maintaining these controls and programmes shall be clearly assigned. The regulatory body shall ensure that a mechanism is put in place to ensure compliance with the restrictions on the future use of the facility/site.

9.4. If radioactive waste is stored on the site after decommissioning has been completed, a revised or new, separate authorization for the waste storage facility shall be sought from the regulatory body. This authorization shall include requirements for decommissioning of the storage facility.

9.5. In the case of the release of part of the site from regulatory control, a revised or new, separate authorization for the reminder of the site remaining under regulatory control shall be sought from the regulatory body, as appropriate.

9.6. Public inputs shall be addressed before authorization for decommissioning is terminated.

9.7. A system shall be established to ensure that all records are maintained in accordance with the requirements for retention of records specified in the integrated management system and with the regulatory requirements. This system shall ensure that the new users of the site after its release from regulatory control are informed about the presence of a facility on the site in the past, and about the nature of the activities that have been conducted at the site.

REFERENCES

[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, 2007 Edition, IAEA, Vienna (2007).

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

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3 (Interim), IAEA, Vienna (2011).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev. 5), IAEA Nuclear Security Series No.13, IAEA, Vienna (2011).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1, IAEA, Vienna (2010).

[7] 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 OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GS-R-2, IAEA, Vienna (2002) (under revision).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4, IAEA, Vienna (2009).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for Facilities and Activities, IAEA Safety Standards Series No. GS-R-3, IAEA, Vienna (2006) (under revision).

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

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material, 2012 Edition, IAEA Safety Standards Series No. SSR-6, IAEA, Vienna (2012).

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