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General Nuclear System Ltd.

UK HPR1000 GDA Project

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Preliminary Safety Report
Chapter 24
Decommissioning

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24.1 List of Abbreviations and Acronyms

ALARP	As Low as Reasonably Practicable
BAT	Best Available Technique
CGN	China General Nuclear Power Corporation
EA	Environment Agency
FCG Unit 3	Fangchenggang Nuclear Power Plant Unit 3
GDA	Generic Design Assessment
HPR1000	Hua-long Pressurized Reactor
HPR1000(FCG3)	Hua-long Pressurized Reactor under Construction at Fangchenggang nuclear power plant unit 3
IAEA	International Atomic Energy Agency
NDA	Nuclear Decommissioning Authority
PCER	Pre-Construction Environment Report
PCSR	Pre-Construction Safety Report
PSR	Preliminary Safety Report
SAP	Safety Assessment Principles for Nuclear Facilities
SFIS	Spent Fuel Interim Storage
SFP	Spent Fuel Pool
UK HPR1000	The UK version of the Hua-long Pressurized Reactor

24.2 Introduction

Decommissioning of large nuclear power plants is a complex and long-term project, involving nuclear safety, radiation safety, environment protection, decontamination and dismantling, radioactive wastes treatment and disposal, plant site restoration, etc. World nuclear power plant best practice indicates that although decommissioning is the last stage of the entire life of a nuclear power plant, it should be considered through all the stages of siting, design, construction, operation and decommissioning of the nuclear power plant, Reference [1].

This chapter is a Preliminary Safety Report (PSR) related to decommissioning of the UK version of the Hua-long Pressurized Reactor (UK HPR1000), including considerations of the design phase, operation & maintenance phase and decommissioning phase in the future. This chapter is consistent with the claims in Reference [2]:

- The generic design of the UK HPR1000 can be safely and effectively decommissioned at the end of its operational life.
- The design, and intended construction and operation, and decommissioning of the UK HPR1000 will be developed to reduce, so far as is reasonably practicable, the impact on the workers, the public, and the environment.

This chapter demonstrates the following:

a) Safe decommissioning design: The design of the UK HPR1000 is to facilitate the decommissioning and aims at reducing the exposure dose to the working staff and the public, minimizing the generation of wastes and the impacts on the environment, simplifying the demolition procedure and lowering the cost;

b) Adequate preparation of a decommissioning strategy: An initial decommissioning strategy of the UK HPR1000 is prepared and maintained for site and will be integrated with other relevant strategies; factors influencing the identification of decommissioning type are listed for reference;

c) Adequate preparation of a decommissioning plan: The timing of the decommissioning is rigorously justified, and a preliminary decommissioning plan is prepared and maintained to reflect developments in technologies and techniques, to ensure that the methods adopted for decommissioning are safe and can protect the workers, the public and the environment. The ALARP and BAT considerations will be part of the UK HPR1000 decommissioning plan.

Besides what’s mentioned above, records for decommissioning and other measures that benefit decommissioning will be taken into account.

It is recognized that differences exist between the regulation and critical infrastructure in the UK and China. The considerations of decommissioning for UK HPR1000 will be developed to meet UK regulatory requirements.

24.3 Considerations for Facilitating Decommissioning

The HPR1000 (FCG3) design incorporates a number of features to facilitate decommissioning and to reduce the risks from decommissioning activities. Measures have been taken to minimize the amount of waste produced, and the experience feedback is introduced by:

a) Systematic and progressive reduction of hazards during decommissioning;

b) The minimization of environmental impacts;

c) The facilitation of the dismantling process.

This subsection describes the considerations for the above key aspects, especially the consideration for facilitating decommissioning.

24.3.1 Issues Considered During the Design, Construction and Operational Phases

Decommissioning issues are taken into account during the planning, design, construction and operational stages of the new HPR1000 plant and modifications of the existing plant.

A thorough review of the design features, from the viewpoint of facilitating decommissioning, is performed during the design stage. The design features which assist maintenance and inspection during the operational lifetime also assist decommissioning.

The following considerations will be taken into account for UK HPR1000, based on what have been done for HPR1000 (FCG3):

a) Site selection

1) During siting, detailed initial site radioactivity survey for the site should be performed and relevant records should be kept as one of the important references for site acceptance after the decommissioning in the future.

   A baseline background radiological characterization of the HPR1000 (FCG3) site has been undertaken. This includes appropriate radiological monitoring of the site and its surroundings to establish baseline levels of radiation for assessing the future impact of the reactor on the site. It’s also one of the reference systems for further decommissioning.

2) Atmospheric dispersion and water dispersion of radioactive materials at the site should be evaluated. Site conditions should avoid or reduce the deposition of radioactive materials and the contamination to earth and water, so as to reduce the difficulty and workload during clearing and decontamination of site radioactivity during decommissioning;

3) To adapt to the need of different decommissioning strategies in the future, the impact on long-term integrity of buildings and other structures should be considered during evaluation of meteorological conditions such as extreme

temperature, rainstorm or flood. It should also be considered in the design whether special design precautions should be taken;

4) Transport infrastructure, such as waterways, railways, etc. around the site should be evaluated, ensuring that the wastes generated during decommissioning of nuclear power plants can be transported out of the site;

5) Spaces at or near the site should be considered as the areas for arrangement of decommissioning facilities and storage of wastes generated during decommissioning;

6) Setting and arrangement of utilities (such as fire water supply, potable water supply) should consider the needs of decommissioning, ensuring that these systems can continuously provide services during decommissioning.

b) Careful selection of materials according notably to reference [3] and other good practices:

1) Materials easy to be decontaminated should be selected. The impurity content in materials should be as low as possible, and the selection and use of toxic and hazardous materials should be avoided;

2) The content of elements that are prone to be activated and have a long half-life in equipment materials and sealing materials (such as Co and Ag) should be controlled to reduce activated corrosion products;

3) Materials with dense surface, good corrosion resistance and easy for surface decontamination should be selected. The use of porous materials should be avoided in areas prone to contamination;

4) The use of corrosive, toxic and hazardous substances, flammable liquids, heavy concrete, fiber materials and porous materials should be controlled to reduce the difficulty in waste classification and disposal during decommissioning in the future and also to protect the working staff; and

5) In order to reduce the amount of radioactive wastes generated during decommissioning, the use of reusable or recyclable materials may be considered at the design stage.

c) Optimization of the plant’s systems, equipment, and building (structure) design in Reference [4]:

1) Emptying and decontamination measures should be considered, to reduce the residual radioactive sources inside the facilities after the final shutdown of facilities.

2) Primary coolant should be purified and chemically controlled to reduce the migration and deposition of activation products and corrosion products. Fuel

defects will be identified promptly to avoid fission products in the primary circuit;

3) The equipment should be designed with simple structures to make it easier for drainage, decontamination and dismantling. The internal and external surfaces of equipment and pipes should be smooth to reduce the contaminant accumulation. Connectors, fasteners, fixing devices and supporting devices of systems and equipment should use components with simple structures and smooth shapes.

4) In the equipment design, the design life and replaceability of equipment should be considered.

5) All surfaces of buildings (structures) possibly contacting the radioactive fluids during operation should have coating or metal liners facilitating easy decontamination. Their resistance to corrosion, radiations, shock and flame should be considered for different situations;

6) Floors, walls, coating and metal liners should be flat, smooth and easy to decontaminate, the penetration positions should be reduced and sealed. During dismantling of large components, the bearing capacity of floors should be considered; the floors to be moved during use should be divided into plates or blocks easy to move, and the use of temporary shielding should be considered.

d) Reduction of time necessary to perform a decommissioning task and features minimizing the presence of personnel receiving dose or reducing the likelihood of their contamination.

1) Redistribution of radiation zones during decommissioning;

2) To improve the accessibility of personnel during decommissioning, the personnel passages and equipment passages should be reserved;

3) During the layout design, the arrangement should facilitate the decommissioning work and provide effective shielding during dismantling;

4) Decommissioning staff training and decommission activities simulation training.

e) Maintenance or construction routes facilitating dismantling.

1) Measures to achieve as far as reasonably possible easy access to equipment and easy maintenance, easy in-service inspection and easy removal;

2) Record power plant construction, maintenance, modification information.

Details of how the above considerations are taken into account, notably in the design, will be addressed in the PCSR decommissioning chapter.

24.3.2 Documents and Records to Support Decommissioning

Documents and records that may be required for decommissioning purposes will be identified, prepared, updated, retained and owned so that they are available when needed. Plant operating history will be recorded, including incidents and modifications (if any).

The process of making and preserving these documents and records starts at the planning and design stage and continues throughout the whole lifecycle in an appropriate manner and form, taking due account of the timescales over which these documents and records may need to be retained and accessed.

Besides previous mentioned points, particular attention has been and will be given to records relating to:

a) Design documents, design specifications, drawings and charts related to siting, design, construction and modification;

b) Photos and videos for important construction and installation process including caption, date and annotation for activities, such as earthwork & stonework and concealed structure construction and component assembly methods, especially the assembly and installation methods of components with high activity and high contamination; and

c) Supporting materials of acceptable samples used to identify purity, intensity data and corrosion resistance of irradiated materials, and samples used to distinguish initial radioactivity and radioactivity activated by reactor operation, such as core irradiation monitoring pipes.

The decommissioning document information will be permanently stored in good condition over long periods, and the data will be traceable.

Data gathering and information storage shall be implemented and maintained with an appropriate information technology, including from design phase, which would be established at the very beginning and benefits future decommissioning.

24.3.3 Experience Feedback

Operational feedback is used to draw upon good practice from similar reactors. It is used to identify the implementation of any corrective actions to prevent reoccurrence of events or address other developments adverse to safety in Reference [5].

Experience feedback is published by international organizations (IAEA, WENRA, NEA, EU etc., in scientific and technical publications and conference proceedings. FCG unit3 and other HPR1000 units will be reliable demonstration plants for experience feedback.

It is planned that HPR1000 (FCG3) will be decommissioned after 60 years of operation and it can be expected that decontamination technology, dismantling and cutting technology, and waste management technology may have greatly developed when it is finally decommissioned. There are nuclear power plants of a similar type that will have completed or be carrying out decommissioning, thus HPR1000 (FCG3) can draw lessons from their experience. UK HPR1000 would also benefit from them, in particular by:

a) Undertaking information exchange visitors to other similar decommissioning sites;

b) Employing suitably qualified and experienced suppliers;

c) Participating in decommissioning conferences, seminars and workshops.

24.3.4 Waste Reduction and Waste Hierarchy

The decommissioning of the plant will take account of the waste hierarchy. The waste hierarchy sets out the priority order for managing waste materials based on their environmental impacts. The preference is always to avoid producing waste in the first place. Opportunities to safely reuse or recycle materials are preferable to disposal. Therefore the hierarchy is as follows:

a) Waste prevention and minimization: help safeguard the workforce and reduce environmental impact;

b) Reuse;

c) Recycle;

d) Disposal: if waste cannot be safely and cost effectively reused or recycled it will be disposed of. Waste will be segregated into the various waste categories including radiological and non-radiological where appropriate.

The waste generated during the decommissioning of UK HPR1000 would be processed in accordance with the UK guidance and legislation. The amount of waste will be reduced by separation, segregation, volume reduction, decontamination.

24.4 Decommissioning Strategy

An initial decommissioning strategy is prepared and maintained for HPR1000 (FCG3) and will be integrated with other relevant strategies, such as radioactive waste management strategy. An initial decommissioning strategy for UK HPR1000 would be prepared and presented with more details in the following GDA steps. The strategy will be consistent with UK government policies and strategies, including overall policy aims on sustainable development, and will identify and explain any differences. The UK HPR1000 decommissioning strategy will provide information to address the following claims:

- The generic design of the UK HPR1000 can be safely, environmentally and effectively decommissioned at the end of its operational life.
- The design, and intended construction and operation, and decommissioning of the UK HPR1000 will be developed to reduce, the impact on the workers, the public, and the environment, in accordance with BAT and ALARP principles.

24.4.1 Optional Decommissioning Strategies

According to IAEA and international good practice, there are two viable strategies considered for complete decommissioning of nuclear power plants: Immediate dismantling and safe enclosure followed by deferred dismantling. In principle, these two possible decommissioning strategies are applicable for all facilities.

a) Immediate dismantling: In this case, decommissioning actions begin shortly after the permanent shutdown. Equipment and structures, systems and components of a facility containing radioactive material will be decontaminated and removed to a level that permits the facility to be released from regulatory control for unrestricted use, or released with restrictions for its future use, Reference [1];

b) Deferred dismantling: In this case, after removal of the nuclear fuel from the reactor building, 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 the safe storage of the remaining parts of the facility, Reference [1].

The following several aspects need to be considered comprehensively in determining a nuclear power plant decommissioning strategy:

a) Stakeholders will be defined and their views will be taken into account;

b) Compliance with legislation, policy & guidance which should be applied during decommissioning, including the Nuclear Installations Act 1965 in Reference [6] , HSE Criterion for Delicensing Nuclear Sites in Reference [7], Joint Guidance from EA & NRW on the Decommissioning of Nuclear Facilities, etc.;

c) Characterization of the installation, including the design and operational history as well as the radiological inventory after final shutdown and how this changes with time;

d) Safety assessment of the radiological and non-radiological hazards;

e) The physical status of the nuclear installation and its evolution with time;

f) Adequate arrangements for waste management, such as storage and disposal;

g) Adequacy and availability of financial resources required for the safe implementation of the decommissioning option;

h) Availability of experienced personnel, especially staff of the former operating organization, and proven techniques, including decontamination, cutting and dismantling, as well as remote operating capabilities;

i) Lessons learned from previous, similar decommissioning projects;

j) The environmental and socioeconomic impact, including public concerns about the proposed decommissioning activities;

k) The anticipated development and use of the installation and the area adjacent to the site.

24.4.2 Optioneering

As mentioned above, a number of factors will affect the choice between immediate and deferred decommissioning. In accordance with IAEA guidance and UK current preferred option, immediate decommissioning is feasible and recommended for the HPR1000 (FCG3) and the UK HPR1000.

Immediate dismantling is whereby the source item investigation, decontamination and dismantling will start immediately after final closure of the nuclear power plant to complete its decommissioning activities as soon as possible. More details would be provided in the PCSR decommissioning chapter, which will include:

a) The reasons for recommending the initial decommissioning type (immediate);

b) The risks associated with the initial decommissioning type (immediate);

c) The decommissioning types and the timescales considered;

d) The methodology for determining the relative priorities of decommissioning projects;

e) Information of assumed end state of decommissioning.

Technically speaking, both immediate dismantling and deferred dismantling are available on the HPR1000 (FCG3) and the UK HPR1000, and the decision shall be made by the licensee in the future, taking the above factors into consideration, to meet the dutyholder’s decommissioning objectives, and meanwhile encompass the full extent of the decommissioning liabilities on the site, including existing and planned facilities. The strategy should be reviewed at appropriate intervals and kept up to date.

24.5 Decommissioning Stages

Assuming the decommissioning strategy of immediate dismantling is preliminarily considered for the UK HPR1000, the decommissioning can be divided into four stages that are carried out sequentially:

a) Stage 1 is the preparatory work for decommissioning, which shall be done before final closure of the nuclear power plant, with the main work including the feasibility study of nuclear power plant decommissioning, decommissioning license application, decommissioning design and decommissioning technology research and development. The final decommissioning plan should be prepared at stage 1;

b) Stage 2 decommissioning refers to activities carried out shortly after final shutdown of nuclear power plant. Main work in this stage include: source term investigation, safety maintenance of plant, clean-up of operational waste (including solid waste, sludge and resins, etc.), and preliminary decontamination of the main circuit, auxiliary facilities and process building;

c) Stage 3 decommissioning is carried out based on Stage 2, and tasks are to dismantle all radioactive and non-radioactive systems and buildings outside of the biological shield; treat, store and dispose radioactive waste in accordance with the provisions of regulations; and shield and isolate the remaining reactor body structure to allow the plant site to achieve limited site-release standards. The main work at this stage include dismantling of the main circuit equipment, such as steam generators, coolant pumps, pressurizer and main circuit piping, auxiliary systems and buildings;

d) The main tasks of Stage 4 decommissioning are to dismantle the reactor body, biological shield, prestressed concrete, and finally clean up the site and restore green spaces. The decommissioning is regarded to be completed when the site has been returned to the agreed end state.

These stages will be covered in more details in the PCSR decommissioning chapter, which will include much more information on the above stages, in order to safely complete the decommissioning of the plant to meet the planned final state, doing so in a safe, environmental and effective manner.

24.6 Preliminary Decommissioning Plan

A preliminary decommissioning plan for implementing the decommissioning operations has been developed based on the assumed immediate decommissioning strategy; further details on the safety management arrangements and decommissioning operations are given to enable the safe and systematic and progressive reduction of hazards from the plant after operations finish.

This section provides the initial elements for the implementation of the preliminary decommissioning operations. More details shall be provided in the next GDA steps, which may notably include: preliminary planning, safety case, survey, decontamination, dismantling, radioactive waste management, hazard identification, relevant techniques and logistics. This section provide key activities and principles on the initial decommissioning plan which can be indicative at the current stage of development of HPR1000 (FCG3) .This will be developed further in the next GDA steps.

24.6.1 Timing of Decommissioning

Decommissioning should be carried out as soon as reasonably practicable, taking all relevant factors into account. The timing of the decommissioning should be rigorously justified. Should decommissioning need to be deferred, then this should be explicitly justified in the safety case and strategy as appropriate. The preliminary decommissioning plan would comply with the decommissioning strategy. The timing of decommissioning will be provided in more detail in the PCSR decommissioning chapter.

24.6.2 Key Activities of Initial Decommissioning Plan

The overall period covered by the preliminary decommissioning plan commences with a stage of Pre-Closure Preparatory Work which usually starts five years prior to the final shutdown of plant and ends when all station buildings and facilities have been removed. The objective of the dismantling of the plant on the station is the safe and effective removal of all structure, equipment and wastes from the site utilizing methods for dismantling and waste management which will ensure safety of all personnel, and protection to the public and the environment.

For the purpose of the planning of decommissioning, the process is divided into a number of activities. In general, key activities include: source survey; fuel removal; decontamination; dismantling; waste management.

24.6.3 Source Survey

A survey of radiological and non-radiological hazards is an important input for the safety assessment and for implementing a safe approach during decommissioning and will be conducted to identify the inventory and location of radioactive and other hazardous materials.

An adequate number of radiation and contamination surveys will be conducted to determine the radionuclides, maximum and average dose rates, and contamination levels of inner and outer surfaces of structures or components throughout the reactor installation. The history of the site and facilities is of significance to optimize the full characterization process for the site.

An inventory of all hazardous chemicals present in the installation will be conducted. Hazardous materials such as asbestos require special consideration to prevent harm to human health.

24.6.4 Fuel Removal

The removal of spent fuel from the reactor at the end of its operational lifetime will preferably be performed as part of operations or as one of the initial activities in decommissioning. Its timely removal from the reactor is beneficial and will simplify monitoring and surveillance requirements.

The procedures used for the removal, storage of spent fuel would be expected to be the same as those used during normal operation in HPR1000 (FCG3). That is, the spent fuel remains in the Spent Fuel Pool (SFP) for several years, and then it is transferred to the Spent Fuel Interim Storage (SFIS), in such a way as to control any risk to the public and to the site personnel.

24.6.5 Decontamination

The term decontamination covers the broad range of activities directed to the removal or reduction of radioactive contamination in or on materials, structures and equipment at a nuclear installation. Decontamination may be applied to internal or external surfaces of components and systems, structural surfaces and the tools used in decommissioning.

The objectives of decontamination include:

a) A reduction of radiation exposures during decommissioning activities;

b) A minimization of the volume of the categories of material to be classified or disposed of as solid radioactive waste;

c) To increase the possibility of recycle and reuse of equipment, materials or premises.

A number of decontamination techniques have been developed which may be applicable to decommissioning currently. The applicability of these techniques to the decommissioning project will be thoroughly assessed before selection.

In addition to a BAT/ALARP assessment, an evaluation of its effectiveness will be performed before any decontamination strategy is undertaken or a decontamination technique is selected. In order to ensure that radiation exposures are kept as low as reasonably achievable, this evaluation will include, in accordance with BAT/ALARP principles:

a) The target decontamination level;

b) The estimated doses to workers;

c) Consideration of the possible generation of aerosols;

d) Consideration of the likelihood that available techniques will achieve the target level on particular components;

e) An ability to demonstrate by measurement that the target level has been reached;

f) The availability of facilities required for decontamination and their eventual decommissioning;

g) The cost of the application compared with the expected benefit (e.g. cost of decontamination versus the cost of disposal of original material);

h) An estimate of the volume, nature, category and activity of any primary and secondary wastes;

i) Consideration of the compatibility of these wastes with existing treatment, conditioning, storage and disposal systems;

j) Any possible deleterious effect of decontamination on equipment and system integrity.

24.6.6 Dismantling

There are many available dismantling techniques applicable to reactor decommissioning. Each technique carries advantages and disadvantages in comparison with others. For example, where remote dismantling is necessary owing to fields of high radiation, thermal cutting methods allow the use of relatively simple holding mechanisms. However, these methods generate large quantities of radioactive aerosols requiring local ventilation with filtration systems; this results in the generation of secondary wastes. In contrast, mechanical cutting methods need robust and elaborate holding mechanisms, but these methods usually result in smaller quantities of secondary wastes. Underwater cutting methods have the advantage of enhanced radiation protection, because of reduced generation of aerosols and the shielding effect of the water. However, these methods require, however, special tools and control mechanisms which can operate safely underwater, but usually generate secondary wastes in the form of liquid slurry. Therefore, it’s necessary to compare different solutions and choose the appropriate one based on BAT./ALARP considerations, especially for the main equipment (e.g. stream generator).

Basic cutting, dismantling and remote operating capabilities have been developed and used. The applicability of these techniques to the decommissioning project will be thoroughly assessed before selection.

Selection of methods and techniques to be used in safe dismantling, in line with BAT/ALARP principles, will take into account such aspects as:

a) The types and characteristics (e.g. size, shape and accessibility) of materials, equipment and systems to be dismantled;

b) The availability of proven equipment;

c) The radiation hazards to the worker and the general public, e.g. level of activation and surface contamination, production of aerosols and dose rates;

d) The environmental conditions of the workplace, e.g. temperature, humidity and atmosphere;

e) The radioactive waste produced;

f) The non-radioactive waste produced;

g) The requirement for development work;

Each dismantling task will be analyzed to determine the most effective and safe method for its performance. Some considerations are as follows:

a) Effective methods for controlling airborne radionuclides will be implemented;

b) There will be effective control of discharges to the environment;

c) When underwater dismantling and cutting is used, provision will be made for water processing to ensure good visibility and assist in effluent treatment;

d) The effect of each task on adjacent systems and structures and on other work in progress will be evaluated;

e) Waste containers, handling systems and routes will be defined before the start of dismantling work.

24.6.7 Waste Management

Waste management aims at the safe management of the different categories of waste produced during decommissioning. Consideration will be given to optimizing waste management and minimizing cross-contamination and secondary waste generation. The different categories of waste will be managed through pathways that are proven to be adapted to their characteristics and toxicities (radiological and non-radiological).

Significant reductions in volumes of radioactive waste can be achieved through decontamination, controlled dismantling techniques, contamination control, sorting of waste materials, effective processing and, in some cases, administrative controls or internal audits. Reuse and recycle strategies have the potential of reducing the amounts of wastes to be managed. Similarly, the release of low activity materials from regulatory control (clearance) as ordinary waste or for reuse and recycle can also substantially reduce the amount of material which has to be considered as radioactive waste.

The radiation exposure to workers and the public may vary according to the waste minimization strategy. An integrated approach will be used to balance waste minimization goals with the objective of keeping radiation exposures ALARP and ensuring BAT is applied.

In managing the waste from decommissioning, several factors will be considered. These include:

a) The amount, category and nature of the waste that will be generated during decommissioning (relatively large quantities of radioactive waste may be generated in a short time);

b) The possibilities for removal of waste from the regulatory control regime;

c) The possibilities for the reuse and recycling of materials, equipment and premises;

d) The generation of secondary waste in the decommissioning process and its minimization to the extent practicable;

e) The presence of non-radiological hazardous materials, e.g. asbestos;

f) The availability of waste recycling or treatment plants, storage facilities and disposal sites;

g) Any special requirements for the packaging and transportation of radioactive wastes, e.g. activated materials;

h) The traceability of the origin and nature of the wastes arising from the decommissioning process;

i) The potential impact of the wastes on the workers, the public and the environment.

24.7 References

[1] IAEA, Decommissioning of Facilities, GSR Part 6, 2014.

[2] ONR, Safety Assessment Principles for Nuclear Facilities Revision 0, 2014.

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