

KEY FINDINGS/CRITICAL ISSUES IN THE REVIEW OF THE DECOMMISSIONING PLAN FOR VVR-S RESEARCH REACTOR MAGURELE

Dr. eng. Daniela Dogaru
National Commission for Nuclear Activities Control (CNCAN)
daniela.dogaru@cncan.ro
www.cncan.ro

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Regulatory framework (1)



- Decommissioning – an activity which needs authorization (art. 2 a)
- Operator is responsible to develop a program for the preparation of decommissioning
- The decommissioning program shall be submitted to CNCAN for its approval
- The licensee is responsible for management of all RadWaste generate from its activity

Regulatory framework(2)

- Order no. 14/2000 of CNCAN on the approval of Radiological Safety Fundamental Regulations; (based on the Council Directive 96/29/EURATOM laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation)
 - All practices need to be authorised
 - Dose limits
 - Concepts on Justification and optimisation of practices and limitation of doses
 - Exemption, exclusion requirements, levels
 - Discharge, radwaste requirements
 - Environment monitoring, emergency



Regulatory framework (3)

• Order 180/2002 of CNCAN on the approval of Regulations for decommissioning of nuclear facilities

- It is not applicable to the decommissioning of NPP's
- Requirements for decommissioning of nuclear facilities
- Approval procedure of decommissioning plan
- Content and format of decommissioning plan
- Content of safety case for decommissioning
- Content and format of final decommissioning report
- Content of final radiological survey report
- Content of safety case for release of site from regulatory control
- Content and format of Safety assessment report for spent nuclear fuel dry storage facility



Regulatory framework (4)

- Decommissioning steps:
 - Elaboration and approval of decommissioning plan;
 - Issuing the official decision for permanent shutdown;
 - Obtaining the license for nuclear fuel removal from nuclear installation building;
 - Evacuation of nuclear fuel from nuclear installation building;
 - Elaboration of licensing documentation according to Annex 2 and submission to CNCAN;
 - Obtaining the decommissioning license;

Regulatory framework (5)

- Implementation of decommissioning activities according to decommissioning license;
- Issuing the Final Decommissioning Report at the end of decommissioning activities in accordance with provisions of Annex 4;
- Issuing the Final Radiological Survey Report in accordance with provisions of Annex 5;
- Request from CNCAN and obtaining the Certificate of fulfilment of conditions for release from nuclear licensing regime based on documents submitted in accordance with Annex 7.

Regulatory framework(6)

- Order no. 65/2003 of CNCAN for approval of *Regulations on authorization of the quality management systems* applied to the setting-up, operation and decommissioning of nuclear installations
- Order no. 66/2003 of CNCAN for approval of *Regulations on general requirements for the quality management system* applied to the setting-up, operation and decommissioning of nuclear installations, with subsequent modification and completion
- Order no. 75/2003 of CNCAN for approval of *Regulations on specific requirements for the quality management systems* applied to the decommissioning activities of nuclear installations

Regulatory review procedure

- CNCAN will evaluate the Decommissioning Plan(DP) in term of 60 days from the receiving the application and after all data/information are received ;
- CNCAN shall transmit to the licensee the comments /observations and requirements for additional completion of Decommissioning Plan.
- Domestic meetings will be organized if necessary
- Meetings with the licensee will be organized, if necessary
- Regulatory inspection will be performed, if necessary
- The licensee has the obligation to accomplish in 30 days the CNCAN requirements on Decommissioning Plan, in solicited form.
- If the Decommissioning Plan fulfills the requirements as stipulated in Annex 3 and satisfy all requirements formulated in conformity with art.20, CNCAN will send to licensee the approval of Decommissioning Plan.

History (1)

- IFIN-HH submitted 5 versions of decommissioning plan (DP) between 2002-2003
- All submitted version were rejected by CNCAN
- 2007 May - IFIN-HH submitted to CNCAN for information version 6 – same as version submitted to IAEA
- 2007 July - IFIN-HH performed some minor changes to version 6 – version 7 submitted to CNCAN for a IAEA Expert mission
- 2007 August – IFIN-HH implemented some comments and submitted DP to CNCAN for approval, as version 8

History (2)

- Main reasons for rejection (the first 7 versions):
 - No valid options on management of nuclear spent fuel
 - No options for radioactive waste management (liquid)
 - Poor estimation of quantity of radioactive waste (medium activity)
 - No options for unusual radioactive waste (graphite, beryllium, etc)
 - No options for classical waste (lead, asbestos, etc)
 - Technical support documentation needs improvement

History (3)

- 2008 – CNCAN approved the version 9 of decommissioning plan, with some conditions
- 2010 – IFIN-HH implement CNCAN conditions and prepared the Romanian version of DP - version 10
- 2010 – CNCAN approved the Romanian version of DP - version 10



CNCAN approval of DP version 9

History (4)



Based on:

- DP version 10 approval
- The application & technical support documentation



CNCAN issued the Decommissioning licence for Phase 1. Licence is valid till 2013.

- Repatriation of LEU spent nuclear fuel
- Refurbishment of Radioactive Waste Treatment Facility
- Refurbishment of National Repository
- Separation of common components with DCNU
- Elaboration of DP for phase 2
- Approval of operation licence for DCNU



Decommissioning licence

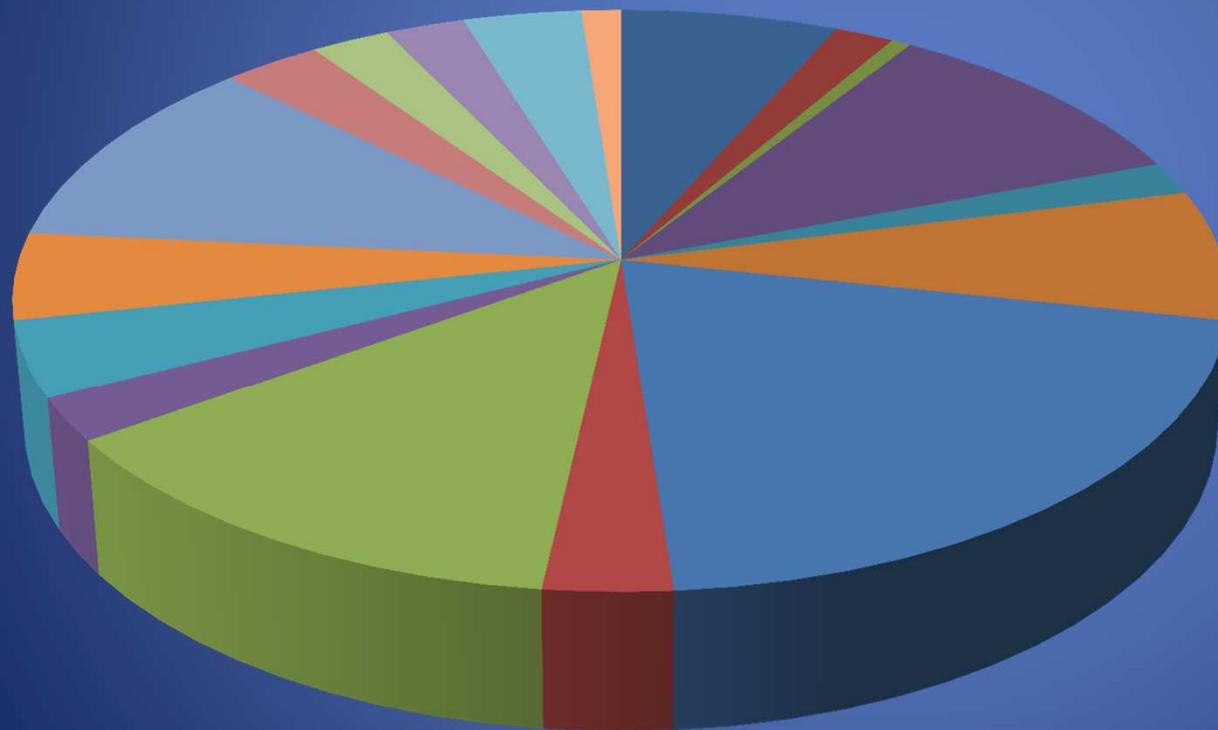
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Key issues - DP, version 9 (3)



- General recommendations
- Executive Summary
- Introduction (Chapter 1)
- Facility Description (Chapter 2)
- Decommissioning Strategy (Chapter 3)
- Project Management (Chapter 4)
- Decommissioning Activities (Chapter 5)
- Surveillance and Maintenance (Chapter 6)
- Radioactive Waste Management (Chapter 7)
- Cost Estimates (Chapter 8)
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- Emergency Planning (Chapter 13)
- Physical Security and Safeguards (Chapter 14)
- Final Radiation Survey (Chapter 15)
- Stakeholder Involvement

General Recommendation (1)

- The scope of the decommissioning effort is unclear.
- The starting point and the conditions upon the beginning of decommissioning and the expected endpoint are not defined.
- A set of clearance levels will be required to CNCAN for restricted and unrestricted use of buildings, land and building rubble.
- The DP should demonstrate the manner in which releases associated with the decommissioning will be integrated with the releases from the remainder of the site so that the site's dose limit is not exceeded .

General Recommendation (2)

- The DP should address the potential solutions to the uncertainties presented in the DP and reflect the impact of those solutions throughout the DP, e.g., cost, effluents, doses, health and safety, etc.
- The sampling results/measurements should include the date they occurred.
- The DP should include a description of the manner in which the depleted uranium rooms in the reactor building will be addressed.
- The DP needs to present clearly the planned spent fuel management activities at the reactor hall.

Executive Summary

- The DP needs to present clearly whether the document submitted to CNCAN is a *conceptual* document on which basis all three phases will be licensed separately, or is it meant for the whole decommissioning process.
- The executive summary needs to be very concise presenting the key information from the document for all three phases, as the whole DP needs to be approved as a prerequisite for any decommissioning licence and funding.

Introduction (Chapter 1)

- There is inconsistent treatment of the issue of the timing of the cleanup and handling of the radioactive waste in the hot cells.
- This should be resolved because there is significant effort required in cleanup of these cells.
- Removal of these waste will facilitate later decommissioning activities and assist decommissioning start up to commence earlier.

Facility Description (Chapter 2) (1)

- The DP is incomplete with respect to:
 - Common systems between building 20 (SNF storage) and the reactor building (No. 22);
 - Addressing inclusion of the 300 m³ tanks (2 pieces) as part of the decommissioning project;
 - Closure of the pipes to these tanks and dismantling of the underground pipes;
 - Description of the status of these components, i.e. are they filled, empty, etc.

Facility Description (Chapter 2) (2)

- There is a discrepancy between the executive summary and Chapter 2.1.4 concerning the management of aluminium and graphite in the DCNU.
- The boundaries of the decommissioning project need to be clearly defined and properly reflected in the text.
- The status of the lifting equipment (i.e. cranes, see Chapter 2.2.3.5) has to be clarified, in order to make clear which parts of the equipment will be operable and what will be their status during the course of the decommissioning.
- Similar considerations apply to other infrastructures, like the dosimetric devices (surface contamination monitors and dose rate monitors).

Facility Description (Chapter 2) (3)

- The number of hand-held monitors seems to be not adequate. Consideration should be given to deploying up to date digital systems in support of the VVR-S decommissioning project.
- The locations of the two exit monitors for the personnel between the controlled area and the supervised area should be clearly defined, e.g. on drawings (Fig. 2.5 and 2.6).
- The fire protection system is not mentioned in Chapter 2, while it is referred to in various locations in the DP. It is recommended that safety aspects of the system, such as for example, the locations of the smoke detectors, the fire control panel etc. are presented and discussed in DP.

Facility Description (Chapter 2)(4)

- The estimation of the activity inventory in the hot cells (Chapter 2.2.2.8) is not clear
- The Chapter needs to be revised to clearly describe that the distilled water circuit and the 30 m³ tank are shared also with the SNF storage building. It should also be outlined in the DP how these systems will be separated prior to the VVR-S decommissioning and how such a separation will not impact the functions associated with the SNF storage building.
- There has been no characterization of the hot cells and the estimates of radioactivity within them appears to be dubious. The radioactive contamination in the hot cells is estimated to be about 15 Ci. The dose rates around the hot cells also have to be presented (e.g. prior to the decommissioning, Phase 1).

Facility Description (Chapter 2)(5)

- With respect to the entire VVR-S reactor, the composition of the contamination (i.e. radionuclide vectors) is uncertain.
- The results of characterisation survey supporting the DP gives reasons to suspect that there are alpha emitting radionuclides present at the reactor building and surrounding area, which would have a high significance for the decommissioning work (respiratory protection etc.).
- The survey report gives reason to believe that alpha contamination is present, but that is confined to some areas, possibly present also in the hot cells. This needs further to be clarified and presented in the DP.

Facility Description (Chapter 2)(6)

- The sampling of soil around the underground piping is not reported in the DP, while IFIN-HH stated that such measurements around the pipework have been done with no contamination findings.
- The two flooding events in the pump room of the reactor building, discussed in Chapter 2.4.3 give a reason to investigate whether some radioactivity had leaked through cracks in the floor of these rooms to the soil beneath the building.
- All historical events related to the reactor building and its surroundings need to be reflected with regard to their impact on the planned decommissioning activities.

Decommissioning Strategy (Chapter 3)

- A short summary of the phases, objectives, endpoints, durations etc. needs to be added to this chapter. This summary also needs to address key issues such as handling of SNF in the near future.
- An illustrative diagram needs to be included in the DP in order to put key events, their sequence and relation/dependence into perspective.
- These tasks need to be linked to the decommissioning phases and their duration.

Project Management (Chapter 4) (1)

- The concept of contingency used in Chapter 4.2.4.2 needs to be reconsidered, as it appears to be a predictable process.
- Contingency in cost estimations is not used to fund out of scope work but it is for unexpected project expenses such as equipment breakdown, weather or labour issues and also in many cases because the work in question is the first of its kind in the particular project or in the particular country and lack of experience leads to cost increase.
- Formal mechanisms for handling changes and change control need to be defined and presented in this part of the DDP.

Project Management (Chapter 4) (2)

- Quality control objectives need to be clearly identified, especially when contractors will be employed.
- Chapter 4.2.5 on the record-keeping system should be expanded to include records from site monitoring.
- The description of the overall duties and responsibilities of the project manager lists the specific responsibilities.

Project Management (Chapter 4) (3)

- The details of the training programs with specific relation to decommissioning need to be explained. In addition the responsibilities and the way of implementation of the training programme for different expert groups (including contractors) need to be added
- Contractor support needs to be described in Chapter 4.7 the way in which contractors will be managed on the site.
- The interactions between IFIN-HH and other external organisations/governmental bodies need to be presented in the DP.
- In addition, the interactions of the relevant groups within the IFIN-HH should also be clarified.

Decommissioning Activities (Chapter 5) (1)

- The replacement of the mixed-bed filter as presented in the DP seems to be not substantiated. It is not mentioned what will be done with the old filter and therefore it is recommended that these aspects are clarified in the DDP.
- The planned painting of the walls to fix contamination will interfere with alpha (and beta) detection to be performed later on. Therefore, characterization must be completed and the walls decontaminated before painting.

Decommissioning Activities (Chapter 5) (2)

- Establishing the radioactive waste transfer routes will require good knowledge of the status of the various installations, especially the DMDR.
- The transfer between levels and from the reactor building to the outside needs to be described in more detail in the DP.
- In addition, a more detailed set of drawings needs to be developed to show the waste routes and the routes for the personnel.

Decommissioning Activities (Chapter 5) (3)

- Re-entry of wood into the VVR-S building during the decommissioning process needs to be avoided. Likewise, gypsum might later cause problems in the radioactive waste disposal facility. The VVR-S decommissioning project should consider the use of metal plates (e.g. aluminium, steel) or other non porous material. It can be decontaminated more easily and therefore create less radioactive waste than gypsum cardboard walls.
- It is important to consider moving, to extend possible, sanitary installations in the reactor building outside the controlled area (if this is not already the case). This will minimize potentially radioactive liquid waste and cost of sampling. However, the fact that some of these areas are no longer within the controlled area does not guarantee that their discharges will not have to be treated as liquid waste. Therefore, if radioactivity originated from that source such as sanitary installations, previously, it is recommended that the waste stream is appropriately controlled by IFIN-HH.

Decommissioning Activities (Chapter 5) (4)

- It is obviously intended to create a separate area in the reactor hall for cutting activities. Depending on the presence of alpha emitting radionuclides, the way to house this cutting area would need to be changed from a tent to a fixed enclosure, and the filtering would need to be adapted, using a backflashable HEPA filter. The filtering system has to be adapted to the cutting method, i.e. mechanical or thermal. This area is tightly related to fire fighting, as fires may occur here.
- Instead of replacing parts of the existing, deteriorated electrical system, it may be more cost effective to use temporary power and mobile electrical supply systems with cabling and mobile cabinets on each floor. Similar considerations apply to the lighting systems, which need to be replaced if they are so old that safe operation cannot be guaranteed. Many decommissioning projects now install temporary power to support decommissioning.

Decommissioning Activities (Chapter 5)(5)

- A list of supporting systems (electric system, ventilation, etc.) that are intended to be installed during the different phases of the decommissioning project need to be presented in the DP.
- The installation of a new compressor inside the reactor building is not advisable, as this item would need to be cleared after its use in the decommissioning project. In addition, the use of compressed air only for drying purposes would probably not be necessary.
- Covering segmented items with plastic sheets will be adequate for the main part of the decommissioning activities. Painting or covering such items with gel coating shall be re-considered. The transport could take place in a standard 200 l drums, and may not need any fixing of the contamination.

Decommissioning Activities (Chapter 5)(6)

- The movement of items from the reactor hall to the DMDR, discussed in Chapter 5.1.10, needs to be re-considered in order to minimize potential exposure to workers (as a result of e.g. packaging, handling) and minimisation of secondary radioactive waste.
- The dismantling of the primary circuit (Chapter 5.13) seems to extend over Phase 2 and Phase 3. Therefore it is unclear which parts of dismantling of the primary circuit will be performed in Phase 3.
- The common use of the secondary circuit of the VVR-S reactor with other systems, e.g. the cyclotron, needs to be clarified in the DP (see also in Chapter 5.3). Otherwise, the secondary circuit could be removed earlier as envisaged in the DP, e.g. in Phase 1, as it is not contaminated. In case that the primary circuit is decommissioned first, there might even be the potential for cross-contamination of the clean secondary circuit. Taking out the secondary circuit early would also provide good training means for the IFIN-HH workforce.

Decommissioning Activities (Chapter 5) (7)

- The transfer of SNF to Russia (not to final disposal) needs to be completed before Phase 2 commences, not within Phase 2 .
- In Chapter 5.2.5, the decontamination process for the hot cells is addressed. As the drains are apparently blocked and the treatment of liquid waste from the envisaged decontamination process is not clearly defined in the DP.
- The handling of liquid waste from the hot cells, as well as the overall VVR-S reactor building should be addressed, if the hot cell drains will not be operable during decommissioning.
- The use of decontamination processes not generating liquid wastes need to be considered in DP like steel grit blasting systems, as water will probably penetrate into the concrete walls. It is to be suspected that the cells will not be tight. The potential of resulting liquid waste to leak outside the rooms and spread contamination also needs to be considered.

Decommissioning Activities (Chapter 5) (8)

- The fate of the reactor building is described in Chapter 5.3. and especially the “reclamation” of the land in conjunction with the 6 m soil layer and planting mentioned in page 98 need elaboration and clarification (e.g. future of underground structures and pipes). Should it be required to demolish the building, it could have a significant impact on the overall decommissioning costs. If the building is removed, the soil below the foundation would have to be sampled and if necessary cleaned up.
- Planning of the decommissioning work and procurement of equipment for Phase 3, as well as the elaboration of the related technical documentation needs to take place before the beginning of this phase, not during its execution.
- The environmental clean-up is not described in detail and is only mentioned as a task. More detailed description of these activities in the DDP is needed.

Decommissioning Activities (Chapter 5)(9)

- The process for demolition of the hot cells is not clearly defined. The use of the Brokk system for demolition of the hot cells may not be possible if deployed in the basement due to size restrictions (current size). This should be re-evaluated and a more realistic approach developed.
- Lifting equipment is to be kept in service and therefore will be used during the decommissioning process. If the building should become unstable during the decommissioning process, then the cranes would become inoperable. They would then need to be dismantled, characterised and cleared or treated as radioactive waste.
- The question remains how clearance measurements will be carried out and whether these activities are considered in the cost estimation and waste management part of the DP. Associated industrial hazards also need to be presented and discussed in the DP.

Decommissioning Activities (Chapter 5) (10)

- Application of wet decontamination techniques for cables, especially when the insulation is broken, as described in the plan, would not be feasible. Alternatives are recommended shall be considered and it may not be cost effective to decontaminate cables and raceways.
- The procedure for complete emptying of the 30 m³ tank is not clearly described in the DP, as the exact specifications of the tank are not known. Separating the tank from the underground piping by cutting will require measures to protect the environment from contamination.
- The concrete waste clearance/evacuation route is not clearly defined.

Decommissioning Activities (Chapter 5) (11)

- The melting of metals from the dismantling operations of the pool (see Chapter 5.3.4) may cause problems if there are special metals like cadmium, lead, etc. present at the VVR-S. Metal melting is a specialized process, especially as it relates to contaminated material. It should be made clear in the DDP what type of melting is intended to be used (i.e. conventional melting in a normal foundry or in a dedicated nuclear melting facility as available in other European countries). A cost-benefit analysis should be considered if a new facility is built for this activity.
- It needs to be clarified whether the waste resulting from dismantling of the electric system (see Chapter 5.3.7) is considered as radioactive or as conventional waste. In addition, a procedure for clearance of cables needs to be developed.
- As mentioned by IFIN-HH during different events, the ventilation system is covered by an asbestos layer. According to Chapter 5.3.9 it is planned to modify the air channels inside the reactor building. In this case the entire ventilation system will have to be replaced. Any type of work with asbestos contaminated materials need to be done in under pressure conditions to avoid dispersion, furthermore all workers will have to wear full suits and external ventilation to avoid inhalation of asbestos fibres. The consequences of this issue with regard to planning, costs and timing need to be reflected carefully in the DDP (see also C7.7).

Decommissioning Activities (Chapter 5) (12)

- The DP calls for the use of a plastic cover of the work area during the decommissioning of the 30 m³ tank. This approach may not be sufficient due to the presence of alpha radionuclides and other contaminants. Therefore a ventilation system might be needed and discussed in Chapter 5.3.10 to limit the dispersal of radioactive material.
- The isolation of systems between the various parts within the reactor building, as well as between various facilities (reactor, fuel storage away from the reactor, etc.) needs to be described. This pertains to the alarm systems, water detection, etc.

Decommissioning Activities (Chapter 5)(13)

- The equipment for dismantling that is intended to be used is mentioned in Appendix 5.2 to the DP. However, a short description of the available tools and of their intended use with respect to the specific dismantling operations in the VVR-S project is necessary in order to evaluate their adequacy.
- The locations of dismantling/decontamination workshops are not properly defined. This is not necessary before Phase 1, but these installations need to be defined before the licence of Phase 2 is granted.
- IFIN-HH should consider for the implementation stage, to prepare a handbook describing the relevant details about how a job needs should be approached, covering all practical issues before, during and after carrying out the work.

Surveillance and Maintenance (Chapter 6)(1)

- The items to be addressed in Chapter 6.2 are dealt with. However it needs to be made clearer until when the specific systems will need to be kept operational during the decommissioning process and how maintenance is carried out. For example, it may be of minor importance that the ventilators of the ventilation system will be kept running for 6-8 h/day, but it may be more important that the ventilation system needs to be kept operational during certain decommissioning activities with operational parameters that must be maintained. Another example is the wet filters which are not described at any other place in the DDP. The procedures for changing these filters would need to be presented and discussed in the DDP.
- The link of the reactor surveillance with the surveillance for the whole IFIN-HH site needs to be outlined.
- Dealing with prevention of illegal entrance into the controlled area would first require definition of the regular and the emergency entrances/exits (see Chapter 6.3). This includes the procedures to be followed when contamination of persons has been detected etc.

Surveillance and Maintenance (Chapter 6)(2)

- The parameters/attributes of the particular systems or components that are being inspected need to be specified in Chapter 6.4.1, i.e. there is a need to specify which types of inspections need to be carried out regularly. As the inspections are performed by the operator, the required qualification of the personnel performing the inspections needs to be detailed.
- Complications with respect to licensing issues, operations, maintenance and surveillance may arise if the SNF will be brought back into the reactor hall for reloading and it was not integrated into the overall decommissioning plan (see Chapter 6.4.5). For example, the level of training for the personnel involved in all aspects of SNF handling would have to be maintained or reinstated to deal with these issues.

Radioactive Waste Management (Chapter 7) (1)

- IFIN-HH shall decommission the existing liquid waste treatment plant. This would be a prerequisite for installing a new stationary liquid waste treatment plant.
- At this time, no decommissioning plan for the existing liquid waste treatment plant has been prepared.
- IFIN-HH needs to develop a decommissioning plan for the liquid waste treatment plant soon if it is planned to install the new plant. It should be noted that a means to process liquid radioactive waste is critical to the successful decommissioning of a project site.

Radioactive Waste Management (Chapter 7) (2)

- The waste quantities for each waste category (primary/secondary waste, very low level waste - VLLW, low level waste - LLW, intermediate level waste - ILW, high level waste - HLW) are provided in the Appendix to Chapter 7. The waste quantities (volumes) are provided, however the (specific and total) activities are missing and should be included. Therefore, a summary table of all types of wastes grouped according to the waste type, waste category and waste destination would be helpful and is recommended to be included in the DP.
- The use of various types of drums is planned by IFIN-HH. However, some of these drum types are not yet licensed, especially not for long-term storage. The long term storage drums (i.e., for a period greater than 300 years) lack a venting mechanism to accommodate gas production and there does not appear to be a specification to qualify the drums for specific use. Any drum to be used has to comply with the Romanian regulations for interim storage. Special care has to be taken when putting graphite from the thermal column (~ 9.3 Mg) into drums to minimise C-14 release.

Radioactive Waste Management (Chapter 7) (3)

- There are no acceptance criteria for processing and for interim storage of radioactive waste in place at the IFIN-HH site. Therefore, IFIN-HH has been asked by CNCAN to prepare a safety report for the waste treatment plan at the IFIN-HH site, however the operator had provided a draft document on this subject to CNCAN, without taking into account the decommissioning waste from VVR-S, but only the waste from industrial, medical and scientific application.
- Dealing with decommissioning waste is problematic as the treatment facilities to be used are not clear.

Radioactive Waste Management (Chapter 7) (4)

- The reference to Appendix 7.1.b in Chapter 7.1.4 does not refer to toxic and dangerous material.
- There is also a need to provide additional information and discussion of the aspects related to the removal of the ventilation systems and the asbestos which is expected to be contained in the systems.
- The quantities of gaseous effluents released to the environment are not linked to the appropriate Chapters 10 and 11 of the DP, where release limits need to be specified (but are currently missing).

Radioactive Waste Management (Chapter 7) (5)

- The use of complexing agents would have an impact on the cementation process and might hinder the solidification process. Chapter 7.2.1 provides some justification how to select the appropriate decontamination process, which could be expanded to accommodate ALARA considerations.
- The provisions for ensuring compliance of the waste packages with the requirements for handling, off site transport, storage and disposal have to be explained in more detail in Chapter 7.

Radioactive Waste Management (Chapter 7) (6)

- The list of waste management equipment and installations in Chapter 7.2.4.1 considered as a pre-requisite for decommissioning needs to be revised with respect to priority, available resources and implementation. Some of the equipment and installations, however, would not be necessary until Phase 2, judging from a practical standpoint. Revision of this list would have an impact on the waste management strategy and costs throughout the DDP.
- A concise waste management strategy is missing.

Radioactive Waste Management (Chapter 7) (7)

- The decontamination of the primary circuit implies strong acids interacting among the different decontamination cycles, leading to an unsatisfactory decontamination result (low decontamination factors, high amount of secondary waste difficult to be treated). This especially is the case when parts of the reactor systems are not accessible to the decontamination solution, e.g. heat exchangers.
- The issue of mixed waste discussed in Chapter 7.3, i.e. contaminated radioactive waste with chemically hazardous material, might need to be addressed in more detail.

Radioactive Waste Management (Chapter 7) (8)

- The DP does not mention procedures by which the radioactive waste will be checked to comply with acceptance criteria for Baita Bihor. As, these procedures exist for the operational and shutdown stage of VVR-S, a link to the appropriate documents would be helpful, as well as justification that these procedures also apply to the decommissioning stage.
- The link to Table 7.2.2 is unclear (presumably, this reference relates to Appendix 7.2). Consistency in the list of drums and other packages needs to be checked, also with the overall figures provided at the end of Appendix 7.2. The estimates of the numbers of waste packages are inconsistent throughout the DP and need to be revised, using an appropriate accuracy (e.g. rounding to hundreds). This includes incorporation the information from Chapter 7.10 into the rest of Chapter 7.

Radioactive Waste Management (Chapter 7) (9)

- The construction of a “transitory waste storage” is referenced for the only time in Chapter 7.5 and therefore needs to be clarified. The same applies to the “storage area of 300 m²”. Different options for aluminium storage are mentioned throughout the DP and these discrepancies need to be avoided.
- The interface between the reactor decommissioning group and the waste management group within IFIN-HH needs to be clarified, in particular with respect to the transition point between both groups and to passing on the responsibility from one group to the other.

Radioactive Waste Management (Chapter 7)

(10)

- Arrangements for return of HLW from reprocessing of VVR-S spent fuel in Russia need to be clarified with respect e.g. to funding, waste storage and impact on the VVR-S decommissioning project.
- Chapter 7.7 deals only with gaseous and liquid effluents and omits solid waste packages. The topic of measurements of waste packages is not dealt with in the entire DP and this aspect needs to be added to the report.

Radioactive Waste Management (Chapter 7) (11)

- The specification when to filter gaseous effluents and when to release them unfiltered is not made clear in the DP. Currently, there do not seem to be any unfiltered effluents from the reactor building. This might be intended to be changed during the decommissioning phase.

Cost Estimates (Chapter 8) (1)

- Neither the cost estimate in Chapter 8 nor the supporting documents give figures on labour costs, estimated work effort, number of personnel, energy costs, fixed costs, investment costs, sub-contractor costs etc., thus not providing enough detail.
- However, a number of important uncertainties identified during the review were considered that would have an influence on the overall cost estimate of 19 M€, e.g. demolition of the building, the radiological situation in the hot cells and the DU rooms, contamination of the ground by leakages, liquid waste treatment facility, return of the SNF during Phase 2 etc.

Cost Estimates (Chapter 8) (2)

- The 945 day estimate for Phase 1 seems to be long, judging from experience from other decommissioning projects. The estimated duration for Phase 2 might be too short with 300 days.
- The estimated durations for some tasks (see MS PROJECT plans provided as support for Chapter 5) are questionable, either too long or too short. In particular, the estimation of 40 days for dismantling of the hot cells seems to be inadequate.
- Industry experience indicates there is a possibility that the costs for soil decontamination might be underestimated.

Cost Estimates (Chapter 8) (3)

- It is not clear whether IFIN-HH has included in the cost estimate all items/equipment etc. that will be purchased or only those that will be paid for by Romania (i.e. not those paid for by EU, US DOE, etc.).
- Based on experience, the percentage of the costs allocated to project management is regarded as low.
- The use of subcontractors for disassembling and demolishing the reactor block, the civil works etc. would have an influence on the cost estimate.

Cost Estimates (Chapter 8) (4)

- The funding mechanisms are addressed only in very broad terms in the DP. In Chapter 8.2, more specific information needs to be given with respect to the four main resources for funding, e.g. outlining the difference between national financing and budget financing sources.
- More information needs to be given on how the expected funding mechanisms are expected to work, what percentages of the costs and what part of the decommissioning work they would cover and how probable it is that these mechanisms can be put in place.

Radiological Safety Assessment (Chapter 9) (1)

- The radiological safety assessment does not provide sufficient information to assess off-site consequences to members of critical groups.
- The conclusion of IFIN-HH that there would not be off-site consequences is not supported by calculations/evaluations of relevant scenarios.
- In the light of the fact that some release to the environment might happen as a consequence of internal or external events, the calculation of off-site consequences is essential.

Radiological Safety Assessment (Chapter 9) (2)

- The initiating event of a fire starting inside the reactor building is not included in the safety assessment (see Chapter 9.4). A scenario involving fire is often used (for nuclear power plants and research reactors) as an enveloping scenario for incidents or accidents, as it covers a release mechanism, spread of contamination and release of activity to the environment and thus would address offsite consequences.
- The way in which the initiating events and hazards have been identified by IFIN-HH is not clear from Chapter 9 or the supporting Annexes. The link between the checklist of hazards and the selected scenarios need to be provided in the DP.

Radiological Safety Assessment (Chapter 9) (3)

- If the SNF would be re-introduced into the reactor hall for reloading, appropriate scenarios associated with these activities would need to be evaluated.
- The presentation of the results in terms of risk (Table 9.7-1) is not required according to Romanian regulations. While it is essential to present the evaluation results in terms of dose to workers and public, providing these results in terms of risk requires discussion of the basis and the purpose of the results being presented, i.e. how to demonstrate compliance with criteria.

Radiological Safety Assessment (Chapter 9) (4)

- While analysing a few scenarios, the current safety assessment for workers is not complete with respect to provide an estimate of annual individual doses.
- Furthermore, it does not address collective dose. It might therefore be worthwhile having a more detailed assessment of individual doses and collective dose to the workforce, on an annual basis, from normal decommissioning operation. This dose assessment could be judged against a constraint of 10 mSv/a for planning purposes only, while later in the implementation phase the dose limit 20 mSv/a could be stipulated.

Radiological Safety Assessment (Chapter 9) (5)

- It needs also to be considered whether any incident happening at the reactor might have any impact on a neighbouring facility at the IFIN-HH site (the irradiation facility, the DMDR, the fuel storage building etc.). This could mean physical impacts on the buildings as well as impacts on commonly used systems, like the systems in the fuel storage building that are monitored from the reactor control room as backup.

Environmental Assessment (Chapter 10) (1)

- The sampling programme presented in the DP is not adequate for the VVR-S decommissioning in terms of sampling locations and their distribution in the surroundings of the site.
- More samples need to be taken and in different sectors around the site. The proposed monitoring program runs the risk of being biased towards the points where the current monitoring program samples are routinely taken.
- The proposed monitoring program must account for the releases associated with the decommissioning activities and the respective source terms from such releases.
- Characterization work performed to date has identified the presence of various alpha contamination such as Am-241. This characterization work would imply that additional surface soil and subsurface soil sampling needs to be performed especially in the area of the underground pipes. The sampling programme has to take account of the fact that the decommissioning activities may cause changes in the source terms.
- In summary, the sampling programme cannot rely on the assumption that the existing sampling programme is also good enough for decommissioning; this fact needs to be demonstrated, e.g. by the adequate calculation of doses, characterization and the measurement of effluents.

Environmental Assessment (Chapter 10) (2)

- The DP does not give a clear picture of the site releases of the whole IFIN-HH site.
- The set of pathways to environmental media, and from there to man are not clearly identified. This includes assumptions on dietary habits, local food production etc.
- Figure 10.3-1 does not give all points where measurements are taken, e.g. the points where milk and crops are sampled.
- The environmental sampling points need to be linked to the dispersion model calculations to be sure that samples are taken at the points of highest impact potential.
- In addition, it cannot be assumed that the postulated maximum point is the only measurement point. Points likely to be background location should be included as well as locations though not the maximum likely to demonstrate significant exposure potential.

Environmental Assessment (Chapter 10) (3)

- The information in Chapter 10 is not linked with the gaseous effluents described in Chapter 7 and the dose calculations in Chapter 9. This has to be elaborated further in the DP as the calculation models and the source terms need to be consistent throughout these chapters.
- Chapter 10 has also to describe the new monitoring installation for the stack, as currently it is only envisaged to replace the existing installation, but no details are given on the equipment.

Environmental Assessment (Chapter 10) (4)

- The DP needs the radiological consequences from the waste treatment and other IFIN-HH facilities to be included in separate safety assessments. However, these assessments need to be compatible with the one carried out for the VVR-S decommissioning. For example, the DMDR has a separate licence in place, including the safety assessment for the processing of waste in this facility.
- The monitoring programme for the VVR-S reactor needs to be integrated into the overall monitoring programme of the IFIN-HH site. It needs to be described how the programme will be implemented and who carries out the measurements.

Health and Safety (Chapter 11) (1)

- This Chapter addresses the radiation protection programme to the workers and industrial safety aspects. However, it does not consider protection of members of the public (outside IFIN-HH) in cases of incidents or accidents.
- Consistency between the pathways identified in Chapter 9 (safety assessments) and chapter 11 needs to be ensured and hence relevant chapters of the DDP reviewed.
- The ALARA considerations presented in Chapter 11.1 contain training for operators, which has to also pertain to the hot cells.

Health and Safety (Chapter 11) (2)

- An organisational chart would be helpful to be added in the DP illustrating how the responsibilities are distributed and how decision making is carried out between the VVR-S decommissioning team and other IFIN-HH onsite entities.
- The respiratory protection discussed in Chapter 11.1.4 can also be provided by portable systems measuring the airborne concentration.
- Portable air monitors need to be installed in all critical work areas as needed to monitor the aerosols. The procedure that is foreseen for sampling of aerosols and dust will concentrate airborne contamination on filters that can be measured e.g. after one day. This is an additional means for preventing incorporation, which can supplement real-time measurements at critical work areas.

Health and Safety (Chapter 11) (3)

- Existing characterization results had identified the presence of alpha contamination.
- Regular checks presented in Chapter 11.1.5 need to include measurements of alpha contamination.
- Because of the presence of depleted uranium, the fact that the hot cells have not been characterized and because IFIN-HH has not precluded the possibility of returning the SNF to the decommissioning site at some point during or before Phase 2, the potential need for neutron monitoring must be addressed until it can be confirmed that there are no sources which would require neutron monitoring.

Health and Safety (Chapter 11) (4)

- Periodic whole-body measurements and samples of urine and faeces need to be added as means of confirming that no intake of radionuclides has taken place, especially when work has taken place in alpha environments.
- To ensure that the workers in such environments have adequate protection, it may be desirable for them to wear respiratory filters. In such situations, proper fitting of the face mask is essential. Working time restrictions may apply when working with respiratory protection.
- Wearing of complete protective clothing for the operating team during dismantling and decontamination refers to overalls (see Chapter 11.1.5). This is reasonable for controlled areas but it might not be necessary in areas that are definitely uncontaminated. This chapter will need to be reviewed in view of these considerations.

Health and Safety (Chapter 11) (5)

- The value of 100 Bq/cm² for fixed contamination in working environments in controlled areas is acceptable from a radiological standpoint (Chapter 11.1.6). It needs to be resolved what the unit “particles/cm²” means and whether criteria for α and γ -contamination are needed for area and protective equipment contamination.
- Criticality may become an issue if the fuel will be brought back into the reactor building (Chapter 11.2). The question whether criticality may be an issue for the hot cells and the rooms with depleted uranium needs to be resolved. It appears from the discussion in the DPP that criticality is not in other places in the controlled area.

Health and Safety (Chapter 11) (6)

- It needs to be made clearer in the DDP (Chapter 11.3) that the sampling of aerosol releases through the ventilation stack is done continuously, while the analyses of those samples are performed twice a month.
- In addition the necessity for Iodine measurements is not quite clear, while measurements of H-3 and C-14 are not described. H-3 and C-14 can originate from a number of sources as described in Chapter 11.7.4.
- Additional characterisation might be required to determine whether these radionuclides are either not present in relevant amounts to warrant monitoring, or whether measurement/monitoring is required.
- A suitable assessment on the relevance of these isotopes (and other isotopes for which no monitoring is foreseen) needs to be therefore provided in the DDP.

Health and Safety (Chapter 11) (7)

- The indication in Chapter 11.3.2 that removal of graphite from the thermal column may give rise to difficulties needs to be reflected throughout the DP in terms of the decommissioning work plan, cost, safety assessments, waste management, etc. discussed in Chapters 5 (decommissioning work) and Chapter 9 (safety assessments).
- The statement on the primary circuit, being only “slightly radioactive”, may only be valid only after the primary circuit decontamination and is more pertinent to radiological safety assessment.
- Based upon the Chapter in the DP, it appears that the point of emphasis may appear to be that, from an industrial safety standpoint, the primary circuit should present no special industrial hazard problems

Health and Safety (Chapter 11) (8)

- It has to be resolved whether the 10 t crane will stay in the reactor hall, when it will not be removed as part of decommissioning work, or whether it will be dismantled as part of this project. This is important as clearance of the crane might be an issue requiring additional consideration (measurements at the cable, the metal structure etc. may be complicated), but which can be resolved.
- The calculations presented in Chapter 11.7.4.1 need to be reconfirmed. The various references to alpha emitting radionuclides underline the necessity to perform an appropriate alpha monitoring programme.

Health and Safety (Chapter 11) (9)

- The statements on the secondary cooling system tanks potentially containing sediments is misleading, as it may insinuate the secondary system is not uncontaminated as stated.
- The activity of Ca-41 is addressed for the thermal column and concrete, but has not been mentioned in the Detailed Radiological Survey.

Health and Safety (Chapter 11) (10)

- It needs to be clarified in Chapter 11.7.4.3 whether the calculation of doses referred to in Chapter 9 have been made for certain typical decommissioning activities or are in fact estimations for limiting exposure situations (which would be expected to be presented in the Chapter on safety assessment).
- The mechanism to control the work (industrial safety, leading and directing the decommissioning teams) and the supervision of communication (call for assistance, media supply etc.) need to be described in more detail.

Quality Assurance (Chapter 12) (1)

- The quality assurance (QA) Programme presented in the DP appears to be adequate with respect to its aims and scope. The description of the whole programme varies in the various sub-chapters with respect to the level of detail, but still provides an adequate overview.
- The interfaces with sub-contractors, other authorities etc need to be addressed.
- Chapter 12.3.15 on Lessons Learned needs clarification as this applies not only to archiving information, but also to dissemination of this information. Chapter needs to provide guidance on how the information reaches the relevant personnel.

Quality Assurance (Chapter 12) (2)

- The Table 12.3.4-1 does not seem to be exhaustive. The reason for including this Table is unclear. The listed data is recommended to be addressed as examples.
- The QA programme for the reactor needs to be integrated with the quality management system for other operations on the IFIN-HH site.

Emergency Planning (Chapter 13) (1)

- In total, this chapter does not contain enough information for the whole picture on emergency planning.
- It is not clear whether existing emergency procedures would adequately cover the decommissioning project; e.g. how the decommissioning team would communicate with the IFIN-HH emergency team in an emergency situation.
- The current procedures for the possession of the reactor need to be checked for applicability to the decommissioning phases; especially if SNF were brought back into the reactor hall for re-loading or when dealing with the hot cells. One of the reasons for re-working the procedures is that the radionuclides during decommissioning are different from operation.
- Emergency planning for VVR-S decommissioning has to cope with the variety of accidents which may occur during decommissioning. Therefore, the potential accident scenarios need to be discussed in Chapter 9 of the DDP and the manner in which they are responded to in an emergency preparedness sense in this Chapter.

Emergency Planning (Chapter 13) (2)

- Although many situations may be addressed in the Emergency Plan for IFIN-HH site, additional, more precise prescriptions for specific situations may be needed, like containing contamination spreads, changing of clothes etc. This could be summarised in a plan specific to the decommissioning of the VVR-S reactor
- The roles of individuals involved with the VVR-S emergency plan need to be well-defined. Their relationship with the site emergency plan and their interface with individuals in that plan need to be established (who acts on the spot, who coordinates with IFIN-HH etc.), i.e. the lines of responsibilities have to be very distinct and the actions have to be clearly assigned (who reports a fire to IFIN-HH management, to the fire brigades, who orders an ambulance, etc.).

Physical Security and Safeguards (Chapter 14)

- The DP needs to state clearly that the basic physical protection system for the IFIN-HH site and the VVR-S reactor will not change during the decommissioning project and after its completion. Changes to the fence surrounding the reactor and the waste building (DMDR) have been discussed, but are not yet reflected in the DDP.
- The lines of responsibility and interaction with respect to the physical protection are unclear in the DP, despite of the figure on page 182. This figure pertains mainly to the interaction between the VVR-S Physical Protection Supervisor and the responsible persons in the decommissioning project, as well as the person responsible for the physical protection of the whole IFIN-HH site.
- The text of Chapter 14.4.1 refers to access points and pathways, but there is no link to supporting documents and figures.
- The question whether the graphite has to be treated under safeguard considerations (in order not to be misused as moderating material) needs to be addressed in the DP.

Final Radiation Survey (Chapter 15) (1)

- This chapter does not specify the release criteria for buildings and soil. An estimate of what these values might be is essential for initial planning for the decommissioning and establishing such items as cost, radwaste estimates, effluents, monitoring, etc. This may not be necessary to have at this point in time but needs to be developed during the later phases of the decommissioning project. The plan for final survey will evolve with the progress of the decommissioning project.
- This chapter does not address that first a programme (plan, strategy for sampling and measurements) for the final survey needs to be established and then approved by CNCAN prior to implementation.
- Rooms where clearance measurements have been made and compliance with clearance levels has been verified need to be sealed or otherwise protected against re-contamination. These activities need to be reflected in the DP.

Final Radiation Survey (Chapter 15) (2)

- Performing dose rate measurements for a final radiation survey would be meaningless. The use of the other techniques (contamination measurements, gamma spectrometry) need to be outlined to some extent.
- The completion point of the whole decommissioning project needs to be clearly defined, taking into account the two options of (1) unrestricted use of the site or (2) restricted use of the site.
- The survey of the site with respect to non-radiological hazards has to be taken into account in the DDP.

Stakeholder Involvement

- The topic of stakeholder involvement is not dealt with in the DP. It has been partially covered through the approval of the EIA.

Conclusions

- DP & technical support documentation was continuously improved
- A lot of approvals was already obtained
- There are some conditions mentioned in approval of DP version 9 which were not fulfilled
- Even DP is approved , there are some milestone which are not fulfilled:
 - Refurbishment of Radioactive Waste Treatment Plant
 - Refurbishment of National Repository
 - SNF is stored, not transferred to origin country.

Thank you for your attention!