DECOMMISSIONING OF THE SALASPILS RESEARCH REACTOR

by

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In May 1995, the Latvian government decided to shut down the Salaspils Research Reactor and to dispense with nuclear energy in the future. The reactor has been out of operation since July 1998. A conceptual study on the decommissioning of the Salaspils Research Reactor was drawn up by Noell-KRC-Energie- und Umwelttechnik GmbH in 1998-1999. On October 26th, 1999, the Latvian government decided to start the direct dismantling to "green-field" in 2001. The upgrading of the decommissioning and dismantling plan was carried out from 2003-2004, resulting in a change of the primary goal of decommissioning. Collecting and conditioning of "historical" radioactive wastes from different storages outside and inside the reactor hall became the primary goal. All radioactive materials (more than 96 tons) were conditioned for disposal in concrete containers at the radioactive wastes depository "Radons" at the Baldone site. Protective and radiation measurement equipment of the personnel was upgraded significantly. All non-radioactive equipment and materials outside the reactor buildings were released for clearance and dismantled for reuse or conventional disposal. Contaminated materials from the reactor hall were collected and removed for clearance measurements on a weekly basis.

Key words: decommissioning, radioactive waste, clearance measurements

INTRODUCTION

The IRT research reactor at the Salaspils site (SRR) near the capital of Latvia, Riga, was put into operation on September 1961. It was originally built according to a former USSR design, as a pool type light water-water reactor with the nominal thermal power of 2 MW. The main research activities of the SRR are described in [1, 2].

After the physical reconstruction of the reactor in 1975, the nominal thermal power of the reactor was increased to 5 MW. On May 16th, 1995, the Cabinet of Ministers issued Order No. 263, according to which the SRR was to be shut down in two years time (the decision prohibited obtaining fresh nuclear fuel in the meantime).

The relevant technical co-operation project on the decommissioning of the research reactor was submitted to IAEA for years 1997/1998. There were five expert missions from IAEA, starting with July of 1997, up to June 1998. According to the Order of the Ministry of Environmental Protection and Regional Development of January 12th, 1998, a steering group was founded for the promotion of the reorganization of the Salaspils Nuclear Research Centre (NRC) and decommissioning studies.

On June 19th, 1998, the reactor was shut down and a number of assemblies removed from the core. Since 2001, the RAPA state agency is the operator of Salaspils NRC.

PREUSSAG NOELL started the decommissioning and dismantling conception studies of Salaspils NRC in July of 1998. On October 26th, 1999, by Order No. 57 of the Cabinet of Ministers which defined the option of direct dismantling of the SRR to "green-field" and the commencement of the decommissioning and dismantling procedures starting with 2001, prepared dismantling concepts [3, 4] were approved. The decommissioning of SNR has been studied in a report by Cross [5]. Upon environmental impact assessment studies in 2003-2004, an upgrading of the concept was carried out and approved by the Government of Latvia.

This paper deals with data concerning various aspects of the decommissioning procedure of the Salaspils research facility. Primary factors, such as – the organization of decommissioning activities, impact of shareholding, radioactive waste management

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with limited resources, *etc*., are indicated and discussed. As similar projects are planed or underway in many countries, information given here may be used as an additional input for these efforts [6-9].

DISMANTLING AND DECOMMISSIONING OF THE SALASPILS RESEARCH REACTOR

Concept for the decommissioning and dismantling of the Salaspils Research Reactor

The approved concept is based on several important conclusions and objectives to be used in preparations for the decommissioning and dismantling of the SRR in the future:

- SRR is situated in a geographical region with earthquakes measuring up to 6 grades on the Richter scale, but was not designed for such loadings,
- a disposal facility for irradiated fuel or a contract for its transport to other countries does not exist at present. Therefore, an interim storage for irradiated fuel elements in Latvia is necessary,
- a disposal facility for radioactive waste is available in Latvia and is in operation at the moment,
- the precondition to be met is that of choosing the best strategy for the decommissioning of SRR, one which would take into account all economic and safety aspects involved,
- approximately 1500 tons of different materials have to be treated. Around 50% of them can be measured for clearance; the rest has to be conditioned for disposal,
- the required techniques for decommissioning and dismantling of the SRR, as well as those for fuel reloading, are available on the international market,
- the estimated cost of the total dismantling and transition to the "green-field" mode are estimated to amount to 10 million €, and
- the dismantling can be done within a 5-6 years period.

Organization of the decommissioning of SRR

At first, funds for the decommissioning of the SRR were not available. According to Order No. 57 of the Cabinet of Ministers from October 26th, 1999, the Ministry of Environment and Regional Development (MEPRD) was to incorporate the decommissioning activities into the annual state budget and the operator (RAPA Ltd.), to prepare the projects and submit them to the Environmental Protection Foundation of Latvia. As is known [10-12], suitable organization promotes decommissioning activities. The policy adopted was that the steering group, consisting of representatives of appropriate organizations of the MEPRD, as well as of representatives of the Ministry of Internal Affairs, Ministry of External Affairs, and Ministry of Traffic, were to be incorporated into the steering group. All activities were co-ordinated by the steering group and controlled by the Radiation Safety Center (RSC). The principal organizational scheme of the decommissioning procedure which ensures the realization of all decommissioning measures with a necessary measure of control and optimization of investments is shown in figs. 1 and 2.

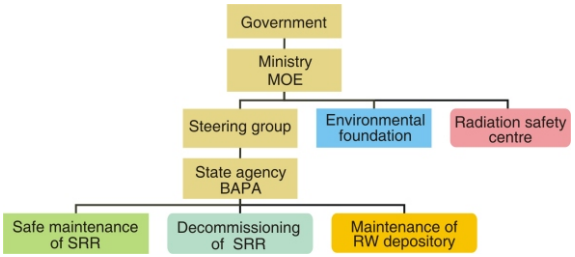

Figure 1. Organizational scheme for SRR decommissioning

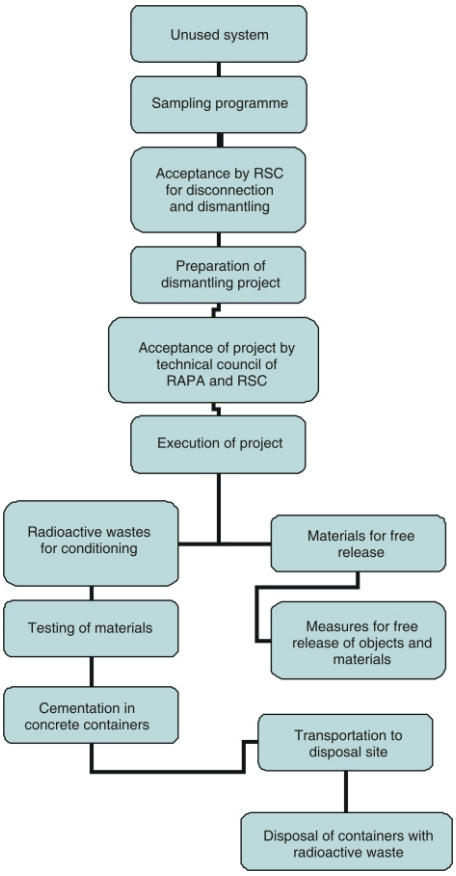

Figure 2. Organizational scheme for dismantling of unused facilities and reactor systems

Execution of decommissioning activities in the Salaspils Research Reactor

Decommissioning activities of the SRR were performed under following circumstances:

– the decommissioning of nuclear facilities was never performed in Latvia before,
– at the time, the infrastructure for decommissioning did not exist in Latvia and the collapse of the Soviet Union severed former connections and support from institutions in the former Russian Federation,
– staff, especially top management, lacked the necessary knowledge and experience, and
– lacking the necessary funds, infrastructure and skills, the decommissioning procedure of the SRR was based on several principles which significantly reduced the total cost of the undertaking.

Tapping into international experience

This principle was used from the very start of the decommissioning project and can be outlined as follows:

Initial preparations this is an important issue which governs the effectiveness of the overall process. The initial decommissioning plan was drawn up by experts of the German company PREUSSAG NOELL [1, 2] and verified under the PHARE program by experts of AEA technology (Great Britain) and INITEC (Spain) [3]. The dismantling plan for SRR was put together by experts of ENRESA (Spain), as a part of the Transition Facility Program of the European Commission.

Training was a key factor in the effectiveness of our decommissioning plans. The SRR decommissioning team was created and trained in 1998, with the support of the German government. It was made up of a Project Manager, Site Manager, Health Protection Engineer, and a Quality Assurance Engineer. The team has since been enlarged by a Procurement Manager, Fire and Industrial Safety Engineer, and a Radioactive Waste Manager.

Technical support during the start-up period of the decommissioning, one of the basic problems was the upgrading of the infrastructure which would allow for effective and safe decommissioning activities, in accordance with the initial decommissioning plan. A number of technical questions were left unresolved and, in some cases, their solution postponed due to lack of financial resources. In general, said technical difficulties refer to:

(1) the upgrading of the disposal facility for radioactive waste,
(2) solution to the tritiated liquid radioactive waste (150 tons)
(3) upgrading of the radiation control and protection system, including stack monitoring and area monitoring systems,
(4) radiological characterization of the bio-shield,
(5) development of cutting systems for the dismantling of the SRR, and
(6) shipment of fresh and spent nuclear fuel for reprocessing.

The bulk of the decommissioning activities was carried out by the IAEA (2-6), DOE (USA) and Mayak (Russian Federation) (6), European Community (1), Denmark, Sweden and USA (3), but a number of interested parties (international stakeholders) have also contributed to the solution of the technical problems mentioned.

Splitting the initial decommissioning plan into annual activities and smaller projects

This principle significantly promoted the implementation of SRR decommissioning measures, since they were all included into the annual State budget and Environmental Protection Foundation of Latvia (EPFL) in the form of projects. The following decommissioning measures were implemented:

(a) collection and verification of data on SRR decommissioning,
(b) decontamination and renovation of the reactor hall,
(c) collection, sorting, and treatment of historical radioactive waste,
(d) disconnection and dismantling of unused reactor systems,
(e) upgrade of the radiation control system on at the SRR site,
(f) establishment of a material's testing laboratory, and
(g) upgrade of the transportation system of radioactive waste.

Splitting of all activities according to material flux from decommissioning

The planning of the decommissioning activities of the SRR took was carried out taking into account the radiological data on objects and materials. To reduce the expenses for the management of different materials, all objects and materials were divided in following groups:

(a) conventional objects and materials after clearance,
(b) weakly contaminated and activated objects and materials,
(c) contaminated and activated objects and materials, and
(d) fresh and spent nuclear fuel.

In accordance with the said classification of objects and materials for decommissioning, all activities for group (a) were performed by foreign companies, on a contract basis. The following activities can be reported as examples of this:

(1) collection and cutting of conventional scrap at the SRR site,
(2) dismantling of the second cooling tower,
(3) dismantling of second cooling system's pumps basement (fig. 3),
(4) dismantling of a 400 m^3 tank in SRR's yard (fig. 4),
(5) installation of a 240 m^3 water reservoir for fire protection purposes,
(6) construction of an interim storage for the decay of radioactive waste and solidification of radioactive waste in containers,
(7) construction of an interim storage for dismantled specific materials like graphite, beryllium, *etc*. which do not fit the waste acceptance criteria (WAC) of the repository, and
(8) upgrade of radiation protection instrumentation, power supply, and security systems of SRR.

All activities concerning objects and materials from group (b) were performed by foreign companies licensed for radioactive materials management, on a contract basis. For example:
(1) strengthening of the reactor hall's walls,
(2) decontamination of the reactor hall,
(3) installation of a treatment facility for radioactive waste, and
(4) dismantling of neutron beam's protection structures.

Materials and objects from groups (c) and (d) were fully managed by the staff of RAPA, Ltd. (transformed into the Hazardous Wastes Management State Agency BAPA in 2005). As an example, the following activities can be reported:
(1) collection and cutting of radioactive materials from the reactor hall (fig. 5),
(2) purification of interim storage rooms for radioactive waste,
(3) dismantling of the primary cooling system,
(4) dismantling of the zero power reactor,
(5) renovation of the spent fuel pool,
(6) treatment of radioactive wastes in concrete containers using tritiated water (fig. 6),
(7) transport of containers with radioactive waste to the disposal facility (fig. 7), and
(8) shipment of fresh fuel to the Russian Federation (2008).

Figure 3. Dismantling of second cooling system pumps basement

Figure 4. Dismantling of 400 m^3 tank in the SRR yard

Figure 5. Cutting of the first cooling systems pipe

Figure 6. Cementation of radioactive waste in concrete container

Figure 7. Radioactive waste in concrete container is ready for transportation

The reuse of the SRR site for radiation related activities

In initial plans dating back to 1999, the final decommissioning stage was foreseen as being "green-field" (in reality, it was envisioned as "brown-field", since the demolition of buildings was not anticipated by the project). In 2003-2004, the initial plan was upgraded and the final stage of decommissioning defined as a reuse of the site for radiation related technologies. Namely, it was concluded that a change in the final stage would result in a saving of 6 millions USD, due to the reduction of needed demolition activities on the site and absence of clearance activities. Environment Impact Assessment (EIA) studies indicated that for a "green-field" option, site remediation activities would amount to a total of up to 20 million USD in expenses. In any case, a 60-year institutional control period after the decommissioning of SRR was defined by the EIA. Taking into account EIA studies and the upgraded decommissioning plan, in August of 2006, the Government of Latvia opted for the construction of the National Multipurpose Cyclotron Center at the Salaspils Research Reactor site. In reality, this means that the reactor building – with its special canalization, ventilation, power supply, radiation monitoring, and security systems – must remain intact upon the decommissioning of the SRR, which will significantly reduce the decommissioning expenses and increase the effectiveness of the decommissioning measures.

Summary of decommissioning activities

The summarization of the results of the decommissioning can be defined by the material flux from the decommissioning procedure. Table 1 contains the information on the dismantled materials flux in the case of SRR.

Table 1. Material flux from the decommissioning of the Salaspils research reactor

Year	1990/0	2001/2	2003/4	2005/6	2007/8	2009	Total
Metallic scraps for reuse and recycling [t]	42	71	75	8	36	4.5	236.5
Concrete for disposal on site [t]	73	281	39	13	4	1	411
Other materials for disposal [t]	41	20	14	4	3	2.5	84.5
Conditioned radioactive wastes [t]	9	32	14	22	7	12	96
Conditioned spent sealed sources and wastes [TBq]	10.8	7.0	0.6	82	141.0	2.0	243.4

Taking into account the upgraded decommissioning plan, remaining activities concerning the decommissioning of the SRR should concentrate on the following tasks:

(a) dismantling of the core of the reactor pool's internals, and
(b) dismantling of the bio-shield.

Both of these activities are in progress at the moment, with the support of international stakeholders and under the auspices of the EC Transition facility program and IAEA technical co-operation projects.

CONCLUSION

Despite the lack of decommissioning funds and limited resources, decommissioning activities of the Salaspils Research Reactor are being carried out successfully and in accordance with national and international legislation and standards.

The involvement of appropriate stakeholder's has significantly promoted the decommissioning of the Salaspils Research Reactor.

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REFERENCES

[1] Iolin, E. M., Prokofyev, P. T., IRT Research Reactor at the Physics Institute of the Academy of Sciences of

the Latvian SSR, *Atomic Energy, 64* (1988), 5, pp. 408-415
[2] Gavars, V., Near to Atom Fission (in Latvian), Zinatne, Riga, 2000
[3] ***, NOELL-KRC, Conceptual Study for the Decommissioning, Dismantling and Radioactive Waste Treatment of the Salaspils Nuclear Research Reactor, Total Dismantling to Green Field Condition, Final Report, Wuerzburg, Germany, 1999
[4] ***, NOELL-KRC, Conceptual Study for the Decommissioning, Disposal and Residual Waste Treatment for the Research Reactor Salaspils, Decommissioning Strategies, Final Report, Wuerzburg, Germany, 1998
[5] Cross, M. T., Clayton, A., Bishop, A., Kinscott, C., Garcia Quiros, J. M., Garcia-Bermejo Fernandez, R., A Report Produced for European Commission TSAF/WL/262/PH2 (Lat), December 1999
[6] Savidou, A., Stamatelatos, I. E., Non-Destructive Technique to Verify Clearance of Pipes, *Nuclear Technology & Radiation Protection, 25* (2010), 2, pp. 133-137
[7] Podlaha, J., Decommissioning of Nuclear Facilities at the Nuclear Research Institute Rez Plc, *Nuclear Technology & Radiation Protection, 25* (2010), 2, pp. 143-151
[8] Lobach, Y. N., Lysenko, M. V., Makarovsky, V. N., Shevel, V. N., Progress in the Decommissioning Planning for the Kiev's Research Reactor WWR-M, *Nuclear Technology & Radiation Protection, 25* (2010), 3, pp. 239-248
[9] Apostolov, T. G., Anastasova, E. I., Anastassov, V. D., Implementation of the Partial Dismantling of Research Reactor IRT-Sofia Prior to its Refurbishment, *Nuclear Technology & Radiation Protection, 25* (2010), 3, pp. 249-254
[10] ***, Nuclear Energy Agency, Decommissioning of Nuclear Facilities – Feasibility Needs and Costs, Paris, 1986
[11] ***, International Atomic Energy Agency. Decommissioning of Nuclear Facilities, IAEA-TECDOC 179, IAEA,Vienna, 1975
[12] ***, International Atomic Energy Agency. Decommissioning of Nuclear Facilities, IAEA-TECDOC -205, IAEA,Vienna, 1977

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ДЕКОМИСИЈА ИСТРАЖИВАЧКОГ РЕАКТОРА У САЛАСПИЛСУ

У мају 1995. године, литванска влада одлучила је да заустави рад истраживачког реактора у Саласпилсу и да се одрекне нуклеарне енергије у будућности. Реактор не ради од јула 1998. године. У периоду 1998-1999. године, урађена је прелиминарна студија о декомисији реактора од стране Noell-KRC-Energie- und Umwelttechnik GmbH, а 26. октобра 1999. године, влада је одлучила да потпуно уклањање реактора започне 2001. године. Унапређење плана декомисије и демонтаже извршено је 2003-2004. године, уз промену основног циља декомисије. Примарни циљ постао је сакупљање и надзор радиоактивног отпада из различитих складишта изван и унутар реакторске хале. Сав радиоактивни материјал (више од 96 тона) био је препакован за одлагање у бетонске контејнере одлагалишта радиоактивног отпада "Радон", на локацији Балдоне. Значајно је унапређена заштитна опрема запослених и опрема за мерење радиоактивности. Сав нерадиоактивни материјал и опрема изван реакторских зграда, отписани су и растављени ради поновног коришћења или уобичајеног одлагања. Контаминирани материјали из реакторске хале били су прикупљени и премештени ради седмичног мерења и документовања.

Кључне речи: декомисија, радиоактивни отпад, мерење радиоактивности