DECOMMISSIONING OF NUCLEAR FACILITIES AT THE NUCLEAR RESEARCH INSTITUTE REZ PLC

by

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The Nuclear Research Institute Rez has been a leading institution in all areas of nuclear R&D in the Czech Republic since it was established in 1955. After more than 50 years of activities in the field, there are some environmental liabilities that need to be remedied. The remediation of old environmental liabilities concerning the Nuclear Research Institute is the only ongoing decommissioning project in the Czech Republic. The nature of these environmental liabilities is very specific and requires special remediation procedures. The process begun in 2003 and is expected to be finished by 2014.

Key words: decommissioning, decontamination, radioactive waste, remediation

INTRODUCTION

The Czech Republic is a country with a developed utilization of nuclear energy. Two nuclear power plants and three nuclear research reactors are currently in operation on its soil. Since the beginning, the nuclear program in the Czech Republic has been supported by the domestic scientific community.

The Nuclear Research Institute Rez (NRI) is a leading institution in all areas of nuclear R&D in the Czech Republic. The NRI has had a dominant position in the nuclear program since it was established in 1955 as a state-owned research organization and has since steadily advanced to its current status. In December 1992, the NRI was transformed into a joint-stock company.

The Institute's activities encompass nuclear physics, chemistry, nuclear power, experiments at the research reactor and many other related undertakings. In the past few decades, the main issues concerning the NRI were concentrated on research and development of services provided to the nuclear power plants operating VVER reactors, the development of chemical technologies for the fuel cycle and irradiation services and development in the industrial sector, agriculture, food processing and medicine.

At present, the remediation of old environmental liabilities at the NRI is the only ongoing decommissioning project in the Czech Republic.

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Table 1 lists facilities with nuclear reactors in the Czech Republic.

The main operator of nuclear reactors in the Czech Republic is CEZ, a. s., which operates nuclear power plants (NPP) at the Dukovany and Temelín sites. Both Dukovany and Temelín NPP were constructed according to Russian projects, *i. e.* as VVER type plants. The Dukovany NPP operates 4 VVER 440 units providing 1760 MW of electrical power. The first unit was commissioned in 1985. Temelín NPP is equipped by 2 VVER 1000 units providing 2000 MW

Table 1. Nuclear reactors in the Czech Republic

Nuclear installation	Type of reactor	Year of start-up	Year of shut-down	Status
NPP Dukovany	4 VVER 440/213	1985-1987	2025-2027	In operation
NPP Temelin	2 VVER 1000/320	2001-2002	2041-2042	In operation
Research reactor LVR-15	Tank reactor 10 MW_t	1957 (VVR-S) 1989 (LVR-15)	2018	In operation
Experimental reactor LR-0	Zero power reactor	1972 (TR-0) 1982 (LR-0)	2008	In operation
Training reactor VR-1	Zero power ractor	1990	2020 or later	In operation
Research reactor SR-0	Zero power reactor	1970	1989	Decommissioned (1997)

of electrical power. Both units started commercial operation by the end of 2004 (commissioning begun in 2000).

The two research reactors, LVR-15 and LR-0, are operated by the NRI, while the educational reactor VR-1 is operated by the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University of Prague.

In 1971, the SR-0 light water assembly with zero output was commissioned at SKODA Plzen. The original allowed output of the system of 100 W_t was increased in 1975 to 2 kW_t. In 1989 the [R-0 reactor was shut-down.

In addition to research nuclear reactors, NRI also operates many research facilities such as hot cells, research laboratories, technology for radioactive waste (RAW) management, radionuclide irradiators, an electron accelerator, *etc*.

LEGISLATION REQUIREMENTS ON DECOMMISSIONING

The SUJB (State Office for Nuclear Safety) is an independent central state administration body in the field of nuclear safety and radiation protection. It has its own budget item approved by the Parliament of the Czech Republic within the state budget. The SUJB is headed by a Chairperson appointed by the Czech government [1].

Act No. 18/1997 Coll. later amended as (Atomic Act) [2] defines the conditions for the peaceful utilization of nuclear energy and ionizing radiation, including activities requiring a license. The Atomic Act was followed by decrees, *e. g*.,

– decree No. 307/2002 Coll., on radiation protection, as amended by Decree No. 499/2005 Coll. [3],

– decree No. 185/2003 Coll., on decommissioning of nuclear installations and workplaces in categories III and IV [4].

Pursuant to the Atomic Act, a Radioactive Waste Repository Agency (SURAO) was established by the Ministry of Industry and Trade. It functions as a state organization responsible for ensuring the safe disposal of RAW and the monitoring and control of repositories during their operation and after their closure. The Agency is funded through levies imposed on RAW producers. It is charged with organizing the disposal of all RAW and SF, if it has been declared as RAW.

According to the Atomic Act, the decommissioning of a nuclear installation is one of the activities associated with the utilization of nuclear power. Decommissioning is defined as a set of activities aimed at clearing nuclear installations or workplaces where radiation activities were performed, so as to make their utilization for other purposes possible.

The preparation for decommissioning shall (in accordance with the Act) be included in each stage of the lifecycle of a nuclear installation. The sitting license documentation for a nuclear installation shall include within the Initial safety report a draft concept for the safe termination of the operation. The licensing documentation for the construction of a nuclear installation shall include, as a part of the Preliminary safety report, the concept of the safe termination of operation and decommissioning of the nuclear installation or workplace being licensed, including the disposal of RAW. The licensing documentation for each commissioning stage of a nuclear installation for the initial fuel load shall also include the proposed method of the decommissioning of the installation approved by the SUJB, as well as the estimated costs of decommissioning verified by SURAO.

The operating license documentation for a nuclear installation shall include the proposed method of decommissioning (preliminary decommissioning plan) approved by the SUJB, as well as the estimated costs of decommissioning verified by SURAO. The scope and method used to realize the proposed strategy of decommissioning are to be approved by the SUJB.

Under the provisions of the Atomic Act, Section 18, based on the estimated total cost of decommissioning, as verified by SURAO, the holder of the operating license is liable for the decommissioning of the nuclear installation and the creation of steady monetary funds deposited in a dedicated and "blocked" account (as defined below) available for the preparation and execution of decommissioning in a timely manner and in a sufficient amount, in compliance with the proposal of decommissioning of the said nuclear installation approved by the SUJB. Decree No. 360/2002 Coll. stipulates the method of providing the proscribed provisions for the decommissioning of a nuclear installation or workplace in categories III or IV. The funds kept in such a "blocked" account shall only be used for the preparation and execution of the decommissioning and drawing on such money is subject to approval by the SURAO. This Act also defines the exceptions to this obligation pertaining to state organizations, public universities or local government bodies, where decommissioning costs shall be born by the state.

DECOMMISSIONING OF THE SR-0 RESEARCH REACTOR

In 1970, the SR-0 light water research reactor with zero output was commissioned at SKODA Plzen. The aluminium reactor vessel with a volume of 3.5 m^3 was located inside the biological shielding consisting of concrete and a water tank. EK-10 fuel of Russian origin with an enrichment of 10% was used.

In 1975, the original allowed output of the system of 100 W_t was increased to 2 kW_t. This was a result of a change in the fuel used to that of IRT-2M, also of Russian origin, with an enrichment of 80%. In 1980, the first reconstruction of the reactor was performed (reconstruction of the reactor internals, control system and ventilation system).

In 1988, the SR-0 reactor was shut-down. The reconstruction of the reactor started in 1989 and was finished in 1991. The new reactor vessel made from stainless steel with a volume of 17 m^3 with new internals was installed into the new biological shielding made from heavy concrete. New ventilation and control systems with new experimental equipment were installed. Non-active testing of the reactor was carried out and the reactor was prepared for the first active experiment with the IRT-2M fuel with an enrichment of 36%. But the reactor was never commissioned and, in 1993, the operational license was cancelled on the request of SKODA. That is when the preparation for the decommissioning of the reactor started.

The SR-0 reactor was completely decommissioned by 1997. The RAW (mainly internals of the original reactor) was processed as RAW. After clearance, other materials (mainly internals of the new reactor, technological circuit, *etc.*) were sold as metal scrap.

The site of the reactor was then used for unrestricted purposes. Only the new reactor vessel without internals remained on the site and was then used as a tank for the chemical treatment of stainless steel components. The new ventilation system and new special sewage system were subsequently used by the new owner of the reactor building as well.

The biological shielding of the old reactor was dismantled and released into the environment. The original aluminum reactor vessel was removed and after small modifications installed in another building of the SKODA company and used for storage of liquid RAW.

The usable experimental equipment was sold to the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University of Prague and used at the site of the VR-1 training reactor.

EK-10 fuel was subsequently used in the research reactor of the Technical University in Budapest, Hungary, and the IRT-2M fuel (with an enrichment of 80% and 36%) was used in the LVR-15 research reactor of the Nuclear Research Institute Rez plc, Czech Republic.

REMEDIATION OF OLD ENVIRONMENTAL LIABILITIES AT THE NRI

After more than 50 years of activities in the nuclear field, there are some environmental liabilities concerning the NRI that have to be remedied. They include the decommissioning of obsolete facilities and the management of RAW accumulated during the operation and dismantling of nuclear facilities.

The goal is to remedy environmental liabilities and eliminate the potential negative impact on the environment. Based on this postulate, optimal remedial actions have been selected and recommended.

The safety analysis report [5] was based on the identification and characterization of potential sources of risk, potentially exposed receptors and exposure pathways, potential chemical compounds, radionuclides, and media of concern. Additional information on natural conditions at the site was obtained through hydrogeologic studies on pollution and information on sources of ionizing radiation and radioactive contamination during dosimetric measurements and radiochemical analyses – also included into this risk analysis.

The results of the said analysis enabled us to determine the priorities of the remediation project [6] and to estimate its expenses, as well. The remediation project was revised on the basis of information obtained during remediation [7].

The remediation of environmental liabilities began in 2003 and will be finished in 2014. Some liabilities have already been successfully remedied.

The remediation of old environmental liabilities at the NRI is the only ongoing decommissioning project in the Czech Republic. The most significant items of environmental liabilities are described below, along with information about the history, current state, progress, and future activities in the field of remediation of environmental liabilities at the NRI.

Decay tanks

The decay tanks have been in use since 1961. The tanks were designed for the storage and decay of concentrated short-lived RAW, but RAW containing long-lived radionuclides was also shipped there. The building is submerged in the terrain on three sides (fig. 1). It contains two cylindrical tanks (length 9.5 m, diameter 3 m, weight approx. 10 metric tons), each with a capacity of 63 m^3 (fig. 2). The decay tanks are made from structural steel jacketed by stainless steel inside

Figure 1. Uncovered bunkers

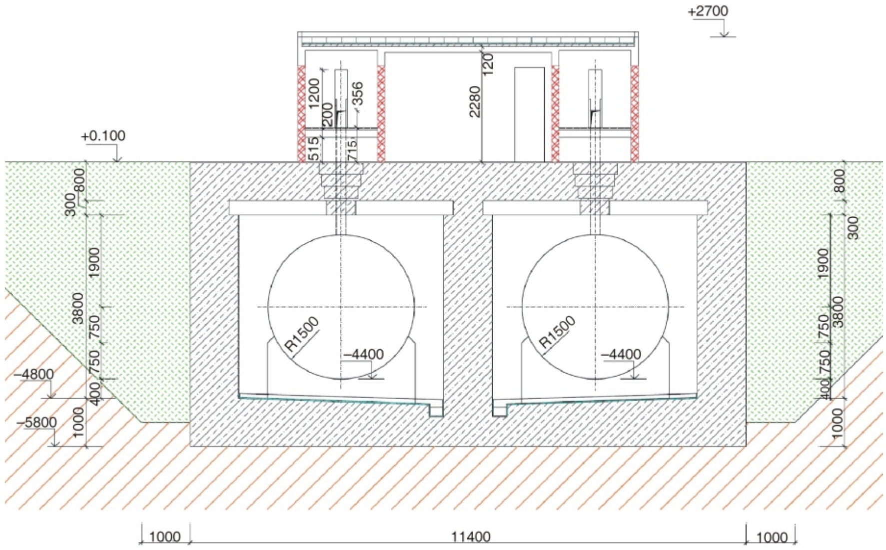

Figure 2. Decay tanks (section)

the vessel. They are placed into two separate concrete bunkers partially situated below ground. A building with tank inlet pipes and ventilation equipment is located above the bunkers.

The tanks contain not only liquid RAW, but tank B also contains solid RAW. The main identified radioisotopes are ^{60}Co and ^{137}Cs. However, the presence of ^{239}Pu is also assumed. Solid RAW consists of tins with irradiated metallic samples and residues of spent fuel. The maximum dose rate is above the pile of solid RAW (hundreds of mGy/h). The leakage from the tanks and direct irradiation from in-situ material were identified as the main risks to the environment and/or to employees.

The remediation procedure will be as follows:
- a hall above the decay tanks has been built,
- the old building located above it was demolished; an industrial concrete-sawing saw was used for the segmentation of the concrete inlets, the disintegration of the concrete structure was done by hydraulic devices,
- a special remote controlled manipulator will be installed into the tank inlet; the control room of the manipulator will be placed in front of the bunker,
- liquid RAW from the tanks will be removed; the liquid from tank A (with lower activity) was transported via a special tank to the facility for liquid RAW processing; the liquids from tank B (with higher activity) are now being cemented on-site with a specially developed cementation unit,
- solid RAW will be moved to a shielding container and transported to a hot cell facility for processing; after that, RAW packed in special cases will be loaded into disposal units and sent for disposal, and
- the tanks will be decontaminated by a high-pressure water jet and abrasive blasting; they will be dismantled and either released into the environment or disposed of; the building will be decontaminated for unrestricted use.

The construction of the facility was finished in 2007; the removal and processing of RAW started in 2009. Decontamination and segmentation of the tanks will be carried out in 2012 and then the building will be decontaminated.

Liquid RAW storage tanks

Three steel tanks of the same design as the decay tanks described above are located in concrete underground bunkers (fig. 3). The tanks served for receiving liquid RAW from the research reactor. The tanks are aged beyond their design life. All three tanks are contaminated by fission and corrosion products, mainly ^{137}Cs, ^{60}Co, and ^{90}Sr. Leakage or spillage of these tanks was identified as the main environmental risk.

According to the original project, the remediation procedure was to comprise decontamination and the dismantling of the tanks and processing of RAW. New tanks for the storage of liquid RAW were to be installed after that. Now a new concept is being realized.

The tanks are being decontaminated and after the investigation of the tanks' integrity, polyethylene linings are being installed inside them.

At the moment, the decontamination of the tanks is being carried out. The surface of one tank was contaminated by a bituminous product from the decontamination of a bitumination unit performed in the past. The application of dry ice blasting was proposed, but it was concluded this could lead to the spreading of contamination. Then a method utilizing organic solvents was proposed, but the amount of solvents needed for this was deemed to be too great; the protection of workers could also prove to be rather demanding. In the end, a very simple method was used – appli-

Figure 3. Storage tank

cation of mineral oils to soften the bituminous layer. The layer was then removed manually, and a very small amount of organic solvent was applied to complete the decontamination. The decontamination of the tanks will be completed by 2011.

Old RAW treatment technology

The old RAW technology was comprised of the evaporation unit, storage tanks and a set of mixed-bed filters. The technology was in operation since 1962 and was shut down in 1992. The total amount of the equipment to be decommissioned corresponds approximately to 50 metric tons of steel. The equipment was contaminated with fission and corrosion products, mainly with ^{137}Cs, ^{60}Co, and ^{90}Sr.

The remediation procedure comprised the dismantling of the equipment after decontamination and processing of RAW. The decommissioning of the technology started in 2004 and will be finished in 2011.

An old evaporation system was used for the treatment of liquid waste. After its leakage, it was shut-down for dismantling. The system consisted of an evaporator, three drop separators, and a condenser.

Because the evaporator was also contaminated by alpha radionuclides (mainly ^{241}Am), overalls with masks supplied with fresh air were used for personal protection during the dismantling.

It was decided to treat and condition the RAW for disposal because of difficult decontamination (strong corrosion of steel parts). It would have been possible to decontaminate the brass tubes, but, with respect to its inner dimensions, it would not have been possible to prove that the release levels were met.

The evaporator consisted of a heater and a separator (fig. 4). The shell was made from carbon steel and the heat exchanger tubes from brass. The heater was heated by steam; the evaporated vapor was separated in the separator. The dimensions of the evaporator were as follows: diameter 1.4 m, height 4.2 m (separator) and diameter 1 m, height 3.8 m (heater).

Figure 4. Old evaporator (upper part)

The dismantling started with the removal of the thermal isolation. The separator was partially dismantled by oxyacetylene cutting before removal because it was not possible to remove it in one piece (it was captured in concrete).

The heater was removed in one piece. The outer shell was dismantled by the nibbler to minimize airborne contamination. The tubes were dismantled by hydraulic shears (fig. 5).

A condenser was used for cooling vapors from the evaporation. The dimensions of the condenser were as follows: diameter 0.7 m, length 4 m. The condenser was made from carbon steel (shell) and brass (heat exchange tubes). Abrasive cutting wheel and hydraulic shears were used for segmentation.

Three drop separators were used for separating water drops from vapors from the evaporation. The dimensions of the drop separator were as follows: diameter 1.4 m, height 2.86 m. The separators were made from carbon steel (shell and internals) and contained special filtration material. An abrasive cutting wheel and oxyacetylene cutting were used for segmentation.

Figure 5. Heat exchanger tubes before segmentation

Contaminated equipment at building No. 250

Building No. 250 houses radiochemical laboratories, hot and semi-hot cell complexes, rabbit systems, and auxiliary equipment [8]. Two laboratories called "Alpha halls" contain eight sets of wall boxes (fig. 6) and a number of glove boxes. The boxes were used for handling alpha radionuclides (U, Np, Pu, Am) and are now significantly contaminated. The total volume of boxes is approx. 80 m^3. Contamination with alpha radionuclides was identified as the main risk to employees.

The remediation procedure will comprise the dismantling of the equipment after the preliminary decontamination and processing of RAW. The dismantlement of the equipment will start in 2011 and will be finished in 2014.

Figure 6. Alpha boxes

Special sewage system

A special sewage system was used for the transfer of liquid RAW from various facilities (research reactors, radiochemical laboratories) to a RAW processing facility. The system consisted of a stainless steel pipe network with a total length of 410 m situated in an underground concrete corridor [9]. The integrity of the system has never been tested. The system was contaminated by fission and corrosion products, mainly by ^{137}Cs, ^{60}Co, and ^{90}Sr. The leakage of waste water from the piping was identified as the main risk to the environment.

The remediation procedure started with the removal of soil and opening of the corridor. Pipes and other steel components (valves, fittings, *etc.*) were removed (fig. 7) and sent for treatment. The total amount of contaminated metal parts was approx. 20 metric tons. Limited parts of the surface of the concrete corridor were contaminated because of small leakages. The contaminated surfaces were removed and RAW processed.

Figure 7. Special sewage system after decommissioning

A standard mechanical saw was used for the segmentation of the pipes before decontamination. Pipe parts such as the joints, flanges, and corroded sections were sent for conditioning. High-pressure water jetting was used for the preliminary decontamination of the pipes. Then an ultrasonic bath with decontamination solutions was used. The decontamination was successful in most cases; some pipes were mechanically decontaminated by a special one-purpose instrument (an abrasive rotating device). The external contamination of the pipes was measured by a standard contamination instrument and the contamination inside the pipes by a special tube detector. Approximately 90% of the pipes were released into the environment.

Decommissioning started in 2004 and was finished in 2005 [10]. After renovation, the old concrete corridor was used for the installation of the new sewage system equipped with a leakage monitoring system.

RAW stored in the Reloading site

The Reloading site was initially constructed as a temporary site to handle conditioned RAW, but was later also used for storage of various RAW before treatment. The RAW was stored in 8 concrete boxes of 5.5 m 8 m 4 m (1400 m^3 total capacity) each. The bases of the boxes are 4 m below ground level and are drained to four closed sumps. The building has a steel roof.

The total volume of stored RAW is approximately 600 m^3. An incomplete inventory is available; this gives only a very general description of the RAW contained in the boxes (fig. 8). The RAW is contaminated mainly with ^{137}Cs, ^{60}Co, and ^{90}Sr. Leakage of liquid waste in boxes, wash-off of contamination from RAW by rainwater and direct irradiation from *in-situ* material were identified as the main risks to the environment and/or to employees.

Figure 8. Stored RAW

With a crane and auxiliary technology, the hall above Reloading site 4 was constructed in 2004 (fig. 9). The RAW will be sorted and transported for processing (segmentation, decontamination, and conditioning). It will then be disposed of or released into the environment. The treatment of RAW will be carried out from 2011 up to 2014. The building will then be decontaminated and, after reconstruction, used as a new RAW storage.

Figure 9. Reloading site with a new hall

RAW stored at the Red Rock storage site

The storage of RAW at the Red Rock storage site started in 1988. The stored waste includes RAW from the reconstruction of the VVR-S research reactor (primary circuit, ventilation system, *etc.*) stored in ISO shipping containers and old technology equipment for the processing of RAW (heat exchangers, tanks, filters).

A view of the storage site is shown in fig. 10. The total storage area is 300 m^2. The total amount of RAW is approx. 90 metric tons. The RAW is contaminated mainly with ^{137}Cs, ^{60}Co, and ^{90}Sr. Rain wash-off from contaminated equipment to soil and groundwater and irradiation from in-situ material were identified as the main risks to the environment and/or to employees.

Figure 10. Red Rock storage

The RAW will be transported for processing (segmentation, decontamination, and conditioning). It will be disposed of or released into the environment. The processing of RAW will be performed from 2011 to 2014.

THE TECHNOLOGY FOR REMEDIATION

The NRI is equipped with the following technologies for RAW management:
- decontamination centre,
- facilities for RAW storage,
- evaporation unit, cementation, and bitumination units, and
- laboratories for decontamination and RAW characterization.

RAW management at the NRI is in accordance with the RAW management strategy of the Czech Republic [11].

The preparation of an inventory of contaminated technology was the first step towards selecting the technology for decommissioning. The result was approx. 1500 m^3 of RAW, corresponding to approx. 600 tons.

Radiation protection is the most important factor in the selection of the decommissioning technology. The level of contamination of RAW is up to tens of MBq/cm^2, the dose rate up to hundreds of mGy/h. There are also other important parameters – type of material, its thickness, accessibility of technology, *etc*.

Further on, an evaluation of the possible uses of various technologies for the segmentation and decontamination with an aim to facilitate management of generated RAW and its release into the environment was performed along with an economic evaluation. Various methods were designed and tested.

Segmentation and decontamination

The list of methods used for segmentation and decontamination is provided in tab. 2.

Table 2. List of methods used for segmentation

Segmentation	Decontamination
Power hydraulic shears	Vacuuming (vacuum cleaner with HEPA filter)
Mechanical saw	High-pressure water jet
Nibbler	Chemical decontamination
Abrasive cutting wheel	Foam decontamination
Oxyacetylene cutting	Ultrasonic decontamination
Plasma arc cutting	Dry ice blasting
In-situ mechanical milling (segmentation of tanks, remote controlled)	Grit blasting (*in-situ*, in box) – considered
High-pressure water jet cutting (considered)	

The selected technology used for segmentation and decontamination is described below.

Ultrasonic decontamination

The decontamination ultrasonic bath with a volume of 1.3 m^3 is used for decontaminating segmented parts. The basic technological parameters are provided in tab. 3.

Table 3. The basic parameters of the ultrasonic bath

Inner dimensions	1400 mm 1150 mm 1000 mm
Active volume	1.3 m^3
Ultrasonic power	17 kW
Basket dimensions	1300 mm 800 mm 700 mm

Dry ice blasting

Dry ice blasting was developed as a safe, clean alternative to bead, grit, and sandblasting. Dry ice blasting has grown to become a vital part of the cleaning process in a remarkable variety of industries throughout the world. The cleaning process utilizes dry ice (solid CO_2) which is formed into 3 mm rice-like pellets or blocks of dry ice which are ground into tiny particles the size of sugar crystals. These particles are then accelerated to supersonic speeds via a blasting unit and applied using a hand-held or robotized blasting gun to the surface to be cleaned. Upon impact, the dry ice immediately turns from its solid state into carbon dioxide vapor, expanding its volume up to 540 times. The energy produced by the conversion of solid to vapor is considerable and is responsible for much of the cleaning process. The vapor disappears back into the atmosphere, leaving only the removed contaminant itself for disposal. The contaminant aerosols, if there are any, are filtered by standard air cleaning methods. Unlike conventional blast cleaning methods, grit, sand, plastic media, *etc.*, dry ice blast cleaning is non-abrasive to the impacted surface. Due to generating gaseous CO_2, it is necessary to use an efficient ventilation system.

For this purpose, two devices are used – Cold Jet Alpheus T-2 and Cold Jet Alpheus SDI-5. Their main advantage is a very small production of secondary waste. The parameters are provided in tab. 4.

Table 4. Parameters of dry ice blasting devices

	Cold jet alpheus T-2	Cold jet alpheus SDI-5
Dry ice feed capacity [kg]	5.4	54.4
Supply air pressure range [bar]	2.4-12.1	2.8-17.2
Weight [kg]	47	195
Size (L W H) [cm]	56 36 51	94 62.2 114.3
Variable dry ice feed rate [kg min^{-1}]	0.2-0.7	0.5-2.7

Technology for RAW treatment

The evaporation unit is used for the treatment of aqueous liquid RAW. The concentrate is cemented into 200 l drums by means of a batch-type cementation unit. The processing of pressable solid RAW involves in-drum, low pressure compaction (into 115 l drums) and the embedding of the 115 l drum within a 216 l drum with concrete.

Disposal of RAW

Approximately 1000 m^3 of solid RAW are expected to result from the remediation process. The standard system of solid RAW processing consists of segmentation and conditioning by cementation into 200 l drums. The drums are then sent for disposal into the repository. A new concept has been prepared for the disposal of big segments of contaminated technological equipment directly into the disposal cells of the repository. From the radiation protection point of view, this should prove advantageous because it should require less segmentation and, at the same time, be less time-consuming and require less resources.

RADIATION PROTECTION

Our remedial activities are being carried out with a high level of radiation protection and up to now no extraordinary event or accident has occurred. The dose obtained by staff is in order of a unit of mSv per year, while the limit is 50 mSv per year or 100 mSv per 5 years.

FINANCING

The Ministry of Finance of the Czech Republic finances the remediation of environmental liabilities. In total, the expense for the remediation of the old environmental liabilities at the NRI will amount to 27 million EUR, approximately.

CONCLUSIONS

The nature of environmental liabilities at the NRI is very specific and requires special remediation procedures. These remedial activities are being carried out with a high level of radiation protection and up to now have not resulted in any extraordinary event or accident.

The remediation of environmental liabilities started in 2003 and will be finished by 2014. Seven of the 14 liability items have already been successfully remedied.

The experience gained during the remediation process will be used for future activities, connected mainly with the decommissioning not only of facilities operated by the NRI (research reactors, radiochemical laboratories, hot cell complexes, *etc*.), but also of facilities operated by other companies (workplaces with ionizing radiation sources, nuclear facilities, nuclear power plants).

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Јозеф ПОДЛАХА

ДЕКОМИСИЈА НУКЛЕАРНИХ ПОСТРОЈЕЊА У ИНСТИТУТУ ЗА НУКЛЕАРНА ИСТРАЖИВАЊА РЕЖ

Од свог оснивања 1955. године, Институт за нуклеарна истраживања РЕЖ водећа је установа у свим областима нуклеарних истраживања и развоја у Чешкој. После више од педесет година делатности у овој области, настала су нека оштећења животне средине које је потребно санирати. Спровођење старих обавеза Института РЕЖ према животној средини у Чешкој представља једини декомисиони пројект који је сада у току. Природа овог деловања у животној околини врло је специфична и захтева посебне поступке спровођења. Процес је започет 2003. године, а очекује се да буде окончан 2014.

Кључне речи: декомисија, деконтаминација, радиоактивни отпад, ремедијација