

## ELEMENTS OF THE RECORD MANAGEMENT SYSTEM FOR THE RA RESEARCH REACTOR DECOMMISSIONING

by

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According to latest recommendations, the record management system of a nuclear facility should operate as a part of the integrated management information system, and is implemented at the very beginning of the facility's life cycle. The record management becomes particularly important at the end of the operation of a facility and then the operational record management system gradually transforms to a decommissioning one. However, there is a significant number of nuclear facilities in the world which have reached the decommissioning stage without having neither the initial decommissioning plan nor the established record management system. The objective of this paper is to introduce constituted elements of the record management system for the decommissioning of the RA research reactor in the VINCA Institute of Nuclear Sciences, and to discuss future planned actions related to this matter.

*Key words: research reactor, decommissioning, record keeping, record management system, quality assurance*

### INTRODUCTION

Research heavy water reactor RA [1-7] was operated in the VINCA Institute of Nuclear Sciences, Belgrade, from 1959 to 1984, using 2% enriched and 80% enriched uranium fuel elements. The total of 8030 spent fuel elements of TVR-S type (USSR origin) have been stored at the RA research reactor premises, almost all in the spent fuel pool filled by ordinary water [8-10]. The last used 480 high-enriched uranium spent fuel elements have been kept in the drained RA reactor core since 1984.

After the temporary shutdown for planned reconstruction and modernization in 1984, due to a number of technical, economical, and political reasons, the reac-

tor had never been restarted [11]. All the plans for the RA reactor refurbishment, initiated during the 18 years of extended shutdown, were abandoned. A proposal for decommissioning of the RA reactor, based on economical, technical and legislative reasons, was submitted to the Federal Government in 2001 [12-13]. During summer 2002, the Governments of Federal Republic of Yugoslavia and of Republic of Serbia brought decisions on the final shutdown of the RA research reactor and its decommissioning [14-20].

Activities related to the RA reactor decommissioning were initiated in 2002 [21] and supported by the International Atomic Energy Agency (IAEA) through the Technical Co-Operation Programme. Main goals in the next 2-3 years are preparation of the decommissioning plan and supporting documents, radiological characterization of the facility, and removal of the existing wastes stored inside the reactor building. It is supposed that the spent nuclear fuel will be removed from the site [22-23] and that the appropriate waste management facilities and temporary storage will be established in the Institute with the aim to allow uninterrupted decommissioning progress. At the same time, these activities require improvement of the national regulatory framework related to nuclear and radiation safety and defining the details of the licensing procedure.

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## RECORD MANAGEMENT SYSTEM

The main sources of information relevant for the decommissioning of a nuclear facility are the records of the design, construction, modification, operation, and facility shutdown phase. It is the operator's responsibility to keep these records. Record management group of the decommissioning team will also have to control the large amount of technical and administrative data that will be generated during the decommissioning process. Therefore, for the efficient manipulation and use of the various records and databases, it would be useful to build an integrated record management system (RMS) within the decommissioning project.

The main goal of an RMS is to provide the necessary, sufficient and up to date information for the decommissioning team and other parties in order to enable proper planning, decision making, and implementation of the decommissioning actions in a safe and cost effective manner.

There are frequent cases of smaller nuclear facilities (*e. g.* research reactors), which records have been badly managed because of the low priority given to decommissioning by research teams and poorly recorded structural and operational changes.

Inadequate records management could lead to delays and additional costs of decommissioning and unnecessary risks from unexpected hazards. This may also be a problem in respect of satisfying the regulatory requirements.

The existing literature about the integrated record management information system for a nuclear facility, and the record management system for the decommissioning as its derivative [24], is scarce and it usually contains the following presumptions:

Nuclear facility information system is established in its construction stage, with the primary purpose to retrieve and manipulate the original design data, records of the possible modifications, as well as the data from the facility's construction and operational stage.

Pieces of information have different sources (*e. g.* the facility operation itself, maintenance, radiological protection activities, and waste management) and various forms (*e. g.* figures, drawings, images, samples, and reports), and thus the most adequate way is to store and access them by a computer system. Such a system typically comprises several distinct databases:

- design record database,
- licensing and statutory record database,
- operation and maintenance record database,
- waste management record database,
- human resource record database,
- health and safety record database,
- quality assurance record database, and
- financial record database.

An initial decommissioning plan is developed during the design and construction of a facility and is regularly reviewed during its operation. Therefore, potentially useful records for the decommissioning process can be timely identified, marked (flagged) and preserved.

Decommissioning RMS is the successor of the existing nuclear facility's information system. It is formed of the audited operational RMS and of the retained important records produced during the decommissioning.

The decommissioning process will in general result in a considerable reduction of the documentation compared to those used for the operation of the facility. This is achieved through the validation of the documents and data that will be utilized for decommissioning. Validation is essential for the safe and cost effective planning of the work programme.

The RMS is an important part of the quality assurance (QA) programme for each nuclear facility. The decommissioning QA programme is usually developed from the operational QA programme. Facilities without the QA programme set would have to develop an *ad hoc* QA programme for decommissioning before that process begins. The documentation should be retained for a well defined period of time and proper QA programme would ensure that records are specified, prepared, authenticated, and maintained by applicable standards, codes, and specifications. This programme also proposes routine review of the quality and completeness of the records, based on the information required.

## RMS FOR THE RA RESEARCH REACTOR DECOMMISSIONING

### Background

At the time decisions about the final shutdown of the RA and its decommissioning were brought, the existing layout of the historical records from the various stages of the facility (its siting, design, construction, commissioning, operation, and extended shutdown period) was relatively poor. There are several dominant reasons for that.

RA research reactor was designed and constructed according to the safety and regulatory standards that did not require initial decommissioning planning and RMS establishment. Also, the reactor was operated in time when electronic data archiving did not exist. After the temporary shutdown in 1984, within the planned reconstruction and modernization, several systems were actually dismantled and some of their parts changed, and those alterations were not properly and completely documented. During the extended shutdown period

(1984-2002), lot of records were not used and/or revised at all.

The majority of the RA historical records consists of paper based documents (books, diaries, reports, atlases, drawings), which were dispersed throughout the reactor building, and partially preserved in impertinent conditions. The operational RMS was not established at all, so the problem with an overwhelming volume of not properly indexed and recorded documents occurred. The specific records for decommissioning were not clearly identified.

Therefore, the selection of the appropriate records for the RA decommissioning and the establishment of the system to manage them were both equally important [25].

### Established RMS elements

#### *RA documentation database*

RA documentation electronic database (the main switchboard shown in fig. 1) is the first element of the future decommissioning RMS, and its main purpose is to ensure that records are categorized and organized, readily retrievable, indexed and placed in their proper location, stored in a controlled environment and corrected or supplemented to reflect the actual status of the facility.

The starting point was classification of all the RA research reactor related documents, records, and files and their assembly at one specified location. In order to ensure proper decommissioning planning and estimation of exposures, waste quantities and costs and due to the significant loss of experienced staff, it was necessary to carefully review all technical documents and compare drawings and data with the existing facility layout.

All those activities finally resulted in the electronic database that stores the following information (fig. 2):

- document unique identification number – the composite record index that consists of: reactor name (RA), room label, locker number, shelf number, and serial number of the record,
- document title,
- document type,
- document author(s),
- document location,
- place and year of publishing,
- key words,
- contact person (employee with the best knowledge about the document contents),
- additional comments,
- flag for the data that may be of particular importance to decommissioning, and
- cross-reference to related document(s).

Relational database model was designed and the application made by using Microsoft Access 2000, Version 9.0, a powerful and robust 32-bit re-

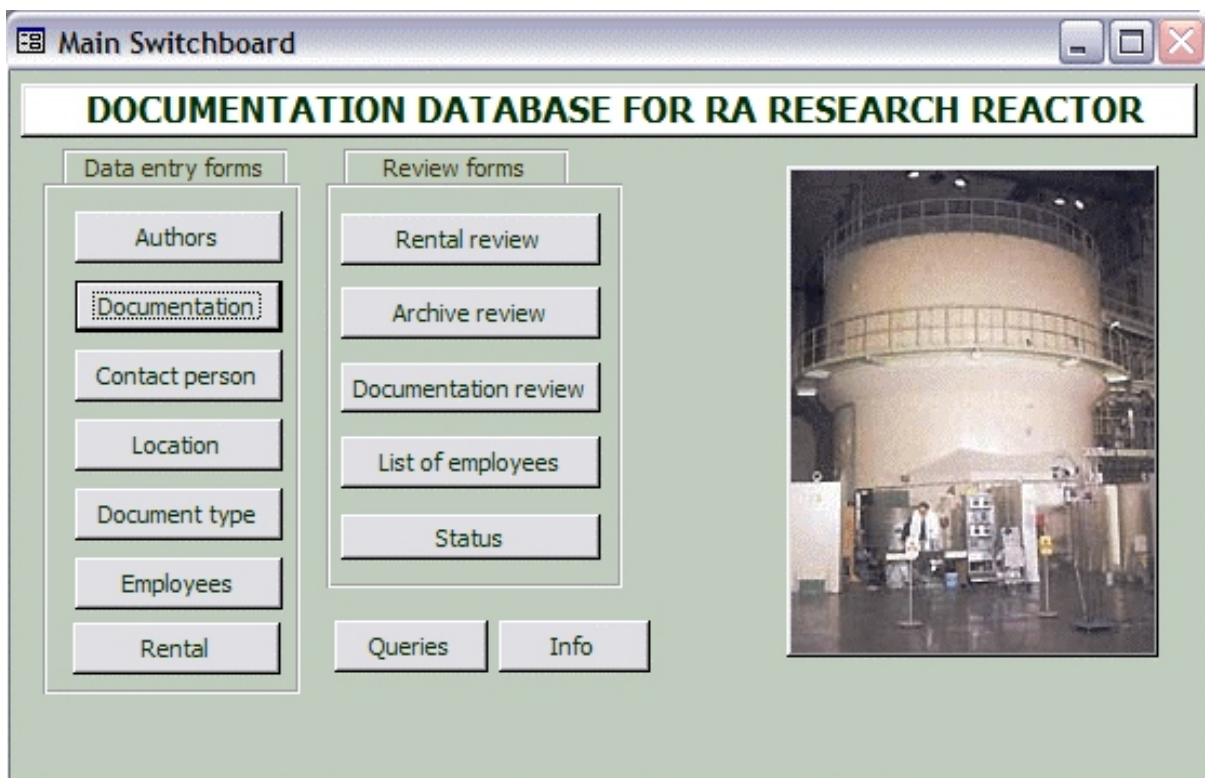


Figure 1. The main switchboard of RA documentation database

**Documentation Review**

**RA REACTOR DOCUMENTATION REVIEW**

Identification number: RA-B-O1-P3-5

Title: Control and Protection System of RA reactor

Key words: Control system, Protection system

Comment: 1 copy in Russian.

Year of publishing: 1987

Place of publishing: SSSR

Pages: 79

Publisher:

Author(s): Unknown

Contact person: Cupać Stevo

Location: RA Library

Document type: Technical description

Enter document identification number: RA-B-O1-P3-5 Find

Record: 1237 of 2345

Figure 2. The document review form from RA documentation database

lational database management system (RDBMS) for creating desktop and client/server database applications that run under Windows 9x and Windows NT 4+. Afterwards, the application was updated to Microsoft Access 2002 (SP1) that runs under Windows XP.

The RA documentation database application allows the document searches by selected criteria (document type, location, key words etc.) and could be used to generate various reports. As an integral part of the RA documentation database the document control system has been established (fig. 3). This system enables finding out the current status for any chosen document (whether it is available or not and, if not, who has it), shows the rental history of the document, and the rental history for any chosen employee through its up to date archive.

In the forthcoming period RA documentation database will continually be updated with all new documents and records generated during the decommissioning process.

#### RA characterization database

The main activities in the first two-three years of the RA reactor decommissioning project are decommissioning planning, and preparation and implementation of the radiological characterization of the facility. Radiological characterization of the RA

reactor, according to developed characterization plan, comprises review of the historical data, implementation of the calculation methods [26], realization of sampling and measurement plan [27], comparison, analyses and review of the data obtained. As the models, procedures and results of the calculation methods are in the electronic form already (prepared, organized, stored, and well controlled), the main problem would be to manage records related to the sampling and measurement part of the characterization process.

During the preparation and realization of the sampling and measurement plan it is necessary to organize, store, review, and process large amount of various data types. The generated documentation has to be treated according to the QA programme requirements with the corresponding monitoring procedures included (how surveys are made, how smears are taken, how samples are collected for spectrometric analysis, etc.). Examples of documents to be considered are records with results of dose rate measurements, surface contamination measurements (e. g., alpha, beta, gamma survey, *in situ* gamma spectrometry), or other instrumental measurements or laboratory analysis (e. g., alpha, beta and gamma counting and spectrometry).

The raw characterization data are obtained in direct measurements and in laboratory analyses and they have to be interpreted, organized and summa-



**Status**

**STATUS AND RENTAL HISTORY**

Choose document:

History

Availability

Choose employee:

Antić Dragoljub

History

Current

Note: For search results to be accurate, you have to archive first!

**Employee's History**

**Employee's rental history**

Document identification number	Rental date	Return date
RA-B-02-P3-30	28-Jan-04	02-Feb-04
RA-B-01-P2-1	03-Mar-04	03-Mar-04

Record: 1 of 2 (Filtered)

Figure 3. Document control system forms

rized in order to prepare the final report about the work and survey operations. This report should be made in such a way that the radiological condition of the entire site is completely and accurately shown, the radiological condition of the components is clearly depicted without the further analysis and evaluation of the data, and that the types and locations of radioactive areas can be readily ratified.

The documentation produced within the sampling and measurement programme for the RA research reactor radiological characterization will be stored in the electronic database, which is considered as a serviceable and efficient tool for the review and further analyses of the characterization results, as well as for the generation of necessary reports [28].

Relational database model was designed and the application is being made by using Microsoft Access 2002 (SP1), a 32-bit RDBMS for the desktop and client/server database applications that run under Windows XP. The main switchboard for the RA characterization database with the links to all the primary data is shown in fig. 4.

Detailed analysis of the sampling and measurement programme from the RA radiological characterization plan has shown that characterization database must comprise the following primary data:

Information about each single measurement (as the result of dose rate, surface contamination direct measurements, or laboratory analysis) like a unique identifier or measurement label, details

including survey date, name of surveyor, sampler or analyst (working team) involved; location of measurement or sample; measured quantity (value, unit, and the error at the required confidence limit), sample and measurement type; used instrument and additional comments.

Information about the spectra analysis data like fractions of various radionuclides, the measured concentration of the specific radionuclides in  $\text{Bqg}^{-1}$  and/or  $\text{Bqcm}^{-2}$ , unique spectrum identi-

**Main Switchboard**

**RA CHARACTERIZATION DATABASE**

Input forms | Review forms | Calculations

Measurements

Spectra

Radionuclides

Meas Types

Samples

Instruments

Rooms

Employees

Teams

Figure 4. The main switchboard of RA characterization database

fier associated with corresponding measurement record, spectrum file path and additional remarks.

Information about the radionuclides important for the RA radiological inventory: nuclide label and mass number, nuclide half life denoted in years, decay type for the given nuclide, minimal detectable activity (MDA), and clearance level. Information about the samples: sample type and associated label to be used in reports, sampling equipment, written sampling procedure.

Information about the measurements: measurement type and label that will be internally given and used in reports, brief description of each measurement type.

Information about the used instruments: instrument name, model and serial number, instrument manufacturer, efficiency and calibration data, background, instrument specification, written measurement procedure, embedded photograph.

Information about the workers' engagement: name and surname of each employee, position in the VINČA Institute, responsibilities within the radiological characterization activities, contact phone, working team the employee belongs to.

Information about the reactor building rooms: room number, room description, and linked datasheet with all the measurements performed in it (fig. 5). For every room in the reactor building the corresponding detailed schematic drawing (Corel 11 file) and associated legend are being prepared. Figure 6 shows one example drawing of the floor in room 049. Working teams will perform sampling and measurements according to the labels and depicted measuring points in these drawings.

The electronic database application for the characterization can easily perform all the necessary

calculations needed for correct interpretation of the primary data. It is made to be utilized in generating the required survey reports, and can be very helpful in the decision making if specific situations occur throughout the characterization process. The same application will be of use in the final radiological survey as well.

### Future steps

In the forthcoming period RA documentation database will widely be used during the preparation of the decommissioning plan and other supporting documents. During the planning and implementation of the decommissioning activities great amount of documents and records of different format will be generated continually. Some records will be only temporary, for example work schedules and permits to work, while others will be permanent, for example radiological survey completion reports or health records.

At the moment, the RA research reactor is going through the transition period between the operation and implementation of the decommissioning plan [29-30]. During this period, safety risks can be decreased by removal of the existing wastes stored inside the reactor building. Defueling the reactor core and removal of the spent nuclear fuel are the main tasks, but also there are a lot of potentially contaminated and activated items mainly located in the reactor hall that can be removed or released for reuse without any dismantling or demolition, *e. g.* before the decommissioning licence issuing. All the waste materials (*i. e.* radioactive, hazardous and nonhazardous) that were present at the beginning of the de-

**Measurements in one room**

Room number: **037**

Show room drawing

**Description**

The room is located at the underground level of the RA reactor building and contains components of the gas (helium) system. The dimensions of the room are 630 cm x 300 cm x 390 cm. Door of the dimensions 100 cm x 175 cm is located on the south wall, 8 cm from the south-west corner. The room has a concrete floor and painted walls. There are no data about unusual events or incidents with the spread of contamination in this room.

The following components of the gas (helium) system are present in the room:

- gas blower "B"
- condenser "B"
- separator "B"

**Measurements**

Label	Date	Time	Value	Unit	Uncertainty	Sample	M.Type	Team	Instrument
037-S5-D-G	25-Mar-04	11:00	35.45	imp/s	0.05	D	G	Fourth Te	E-600 Multipurpose Survey Meter
037-S6-S-LG	26-Mar-04	12:00		spectrum		S	LG	First Team	Gamma Spectroscopy System with Ge De

Record: 1 of 18

Figure 5. The form showing selected room description, its drawing and measurements (RA characterization database)

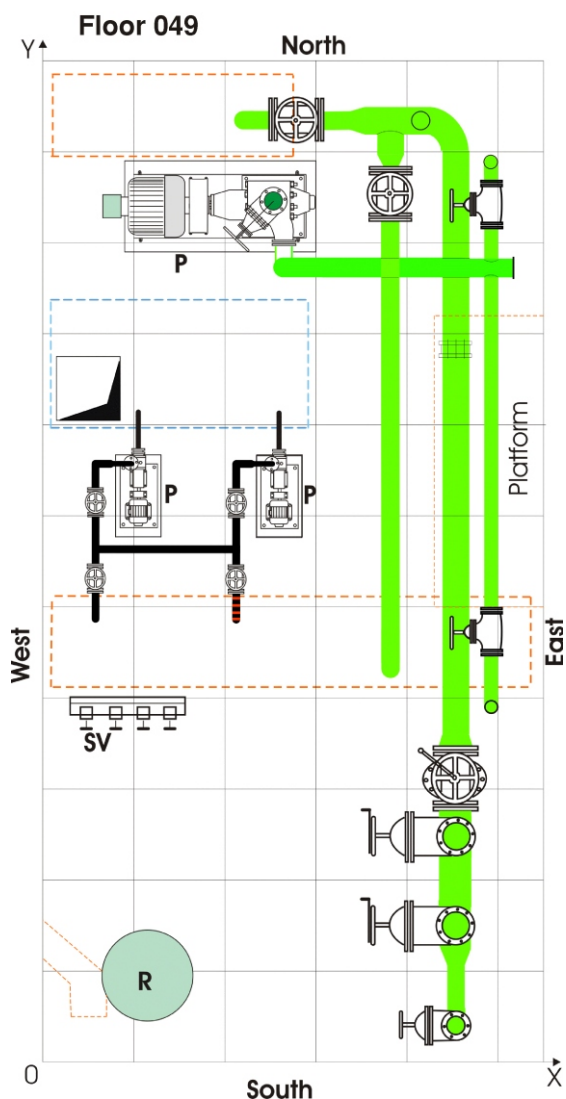


Figure 6. The example of the drawing (room 049, RA characterization database)

commissioning should be properly accounted for and their ultimate destination identified. Appropriate database will be used to manage inventory of the existing wastes and all the actions related to their removal. The same database can be used later for the wastes arisen from the dismantling activities. After each phase of decommissioning, as required, the operating organization will report to the regulatory body on the management and disposal of the waste generated during that phase [31].

RA reactor RMS has to support proper management and organization of the decommissioning project and all the interactions between the parties involved, including the facility operator, regulatory body, contractors, public and other stakeholders, as well as the links with the two other interrelated projects – removal of the RA reactor spent nuclear fuel and waste management at the Vinča site. Records will be generated, requested or required by the dif-

ferent parties during all phases of the decommissioning project until the site release. Managing this cross-flow of information and the related records is a key responsibility and an essential part of RMS.

Microsoft Project software is a powerful tool for the planning and control of the decommissioning activities, their duration, relationships between different activities, as well as human and material resources used. The RA reactor RMS will include Microsoft Project 2002 files as elements that cover planning of the decommissioning activities and reporting on the progress of the decommissioning plan implementation.

Additional elements of the RA reactor RMS will be created to manage health and safety records, including radiation protection and personnel monitoring data, and potential legal and regulatory aspects. For the needs of the final radiological survey already existing RA characterization database can successfully be used.

At the completion of decommissioning project final decommissioning report with the appropriate supporting records will be prepared. These records should be held and maintained for the decommissioning activities completion confirmation in accordance with the approved plan or for recording the disposition of wastes and materials. The RA reactor RMS development will continue until the termination of the decommissioning licence.

## CONCLUSION

Organization and management of different types of information and records important for the RA reactor decommissioning require establishment of the appropriate record management system. First elements of the future RA reactor RMS are already developed and in use: RA reactor documentation database with the associated document control system and the RA characterization database. Other RMS elements will be created and implemented during the course of the decommissioning process.

The RA reactor record keeping approach and experience could be useful for other nuclear facilities that have reached the end of the operational lifetime without established RMS. Developed RMS elements are fully applicable to other nuclear facilities of the similar type.

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**Милијана СТЕЉИЋ, Владан ЉУБЕНОВ**

**ЕЛЕМЕНТИ СИСТЕМА ЗА УПРАВЉАЊЕ ДОКУМЕНТАЦИЈОМ У ОКВИРУ  
ПРОЈЕКТА ДЕКОМИСИЈЕ ИСТРАЖИВАЧКОГ РЕАКТОРА РА**

Према савременим стандардима, систем за управљање документацијом нуклеарног постројења треба да функционише као саставни део интегрисаног информационог система и да буде успостављен још у фази планирања изградње постројења. Управљање документацијом добија нови значај завршетком погона нуклеарног постројења, када систем за управљање документацијом у фази погона постројења прераста у систем за управљање документацијом за процес декомисије. Данас у свету још увек постоји значајан број нуклеарних постројења која су пред декомисијом, а немају прелиминарни план декомисије и успостављени систем за управљање документацијом. У овом раду су представљени до сада развијени елементи система за управљање документацијом за декомисију истраживачког реактора РА у Институту за нуклеарне науке „Винча” и размотрене су планиране активности у вези са његовим даљим комплетирањем.