



***Ministry of Economy, Commerce and Business Environment
Nuclear Agency & Radioactive Waste (AN&DR)***



***General Secretary of the Government
National Commission for Nuclear Activities Control (CNCAN)***

Romania's projects with release of sites and/or buildings

***IAEA Regional Workshop on Release of Sites and Building Structures
27 September – 01 October 2010, Karlsruhe, Germany***

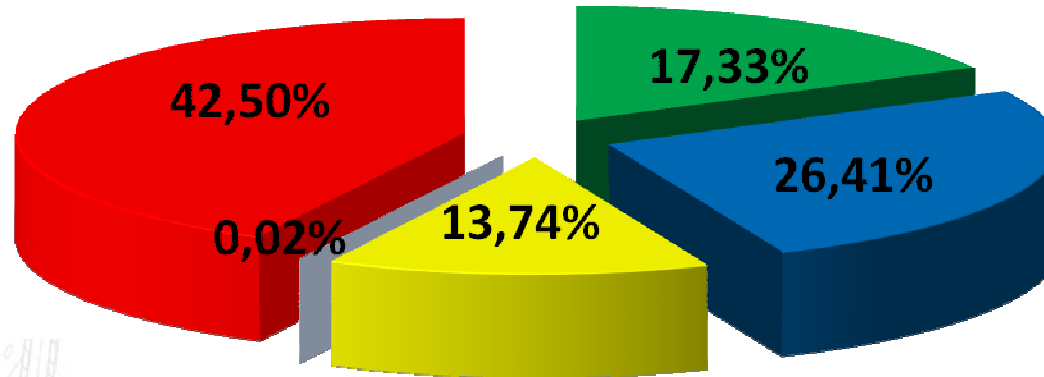


Nuclear authorities

Two authorities:

- **NUCLEAR AGENCY & RADIOACTIVE WASTE (AN&DR)**
 - *Promoter of the nuclear energy development in Romania (power and non – power applications), exclusively for peaceful purposes;*
 - *Responsible for disposal of radioactive waste and spent nuclear fuel, and ensure at national level the coordination of the nuclear installations decommissioning processes;*
- **NATIONAL COMMISSION FOR NUCLEAR ACTIVITIES CONTROL (CNCAN)**
 - *Regulatory body*
 - *National competent authority in the nuclear field, exercising the attributions of Regulation, Authorization and Control of nuclear activities*

Cernavoda NPP



Romania's Energy Structure 2010

■ Nuclear ■ Hydro ■ Gas&Oil ■ Wind ■ Coal

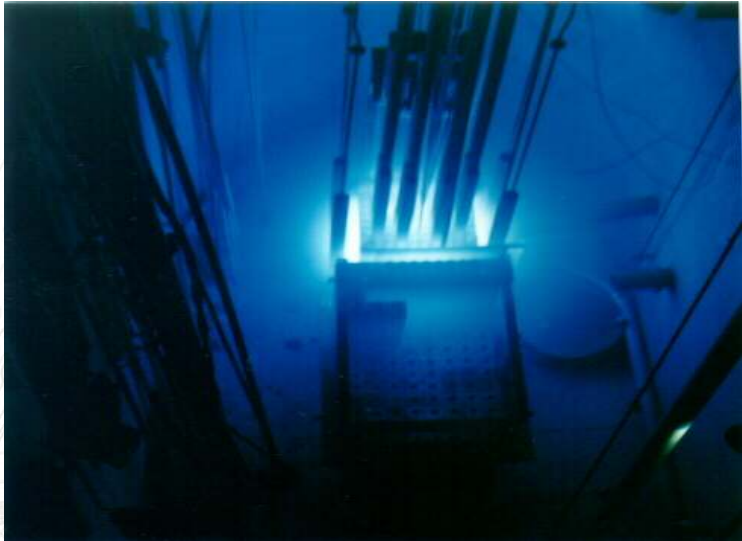


Nuclearelectrica S.A. Units 1 & 2



Energonuclear S.A. Units 3 & 4

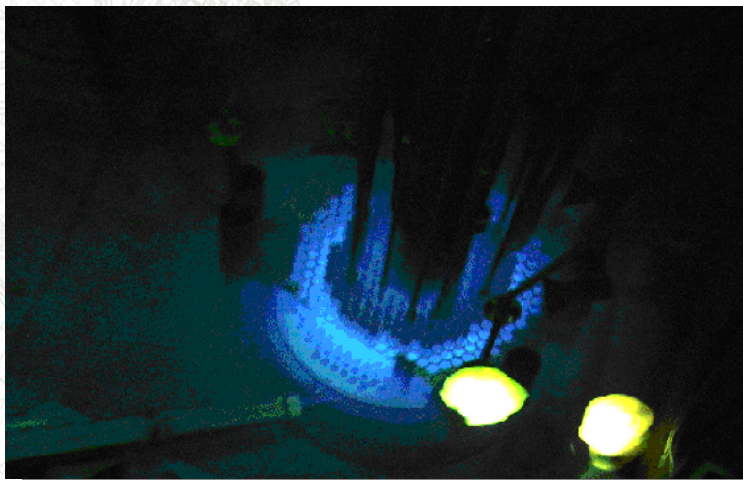
Institute for Nuclear Research - Pitesti



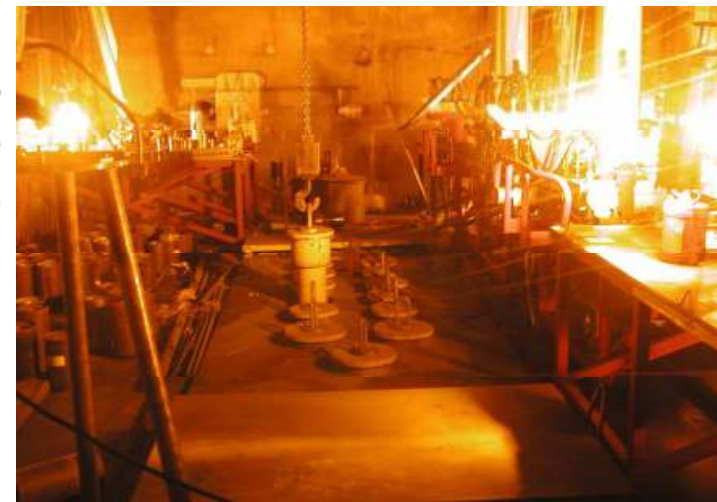
TRIGA 14 MW Steady State Core



Post Irradiation Examination Laboratory



Annulus Core Pulse Reactor (ACPR)



The Dry Storage Pits

“Horia Hulubei” National Institute of R&D for Physics and Nuclear Engineering

VVR-S reactor



- The Spent Fuel Cooling Pool;**
- The Spent Fuel Storage Pools.**

VVR-S Reactor Decommissioning (1)

- ✓ operator and licensee, responsible for decommissioning of VVR-S reactor – “Horia Hulubei” - National Institute of R&D for Physics and Nuclear Engineering (IFIN-HH)
- ✓ ownership: state owned

Principal characteristics of the research reactor VVR-S:

- thermal neutrons research reactor,
- moderately, cooled and reflected by distilled water
- fueled with enriched uranium 10% and then 36 %;
- thermal power: 2,000 kW;

- operated from July 29th, 1957 to December 30th, 1997 when it was shut down;
- Romanian Government Decision 418/25.04.2002 decided the “permanent shut down”

- Immediate dismantling strategy for decommissioning of VVR-S
- Decommissioning activities started in 2009. Duration 12 years. 3 main stages
- Objective: the unrestricted release of the reactors facilities (building) and site from CNCAN regulatory control
- End use: Industrial application , R&D in the material sciences, radiological facility-linear accelerator

VVR-S Reactor Decommissioning (2)

Legislation framework

Regulation on decommissioning of nuclear facilities (NSN-15) describe decommissioning licensing methodology to ending the nuclear activities and release from regulatory control methodology.

Radiological Safety Fundamental Norms (NSR-01) based on the Council Directive 93/26/EURATOM and on the IAEA Basic Safety Standards no. 115 on International Basic Safety Standards for protection against Ionizing Radiation and on the Safety of Radiation Sources. Annex 2 of Radiological Safety Fundamentals Norms, **levels of exclusion (clearance) and exemption.**

Norms on Clearance Levels of Radioactive Materials Arising from Authorised Nuclear Activities (NDR-02). The regulation contains the methodology for approving by CNCAN of the conditional or unconditional clearance of materials.

Regulations on Limiting the Radioactive Effluents Releases into the Environment (NDR-04) set the principles and the general requirements on liquid and gaseous radioactive effluents releases in the environment, as well as the authorisation and monitoring (control) activities for these discharges.

VVR-S Reactor Decommissioning (3)

The release criteria under the authorization regime

OBJECTIVES:

-Release from regulatory control of materials resulting from nuclear activities in a manner that the radioactivity content of these materials shall not involve a significant risk for public and environment (does not apply to the release of effluents)

-It is considered that release from regulatory control do not involve significant risk for public and environment if, as a result of analysing of the pathways of exposure, results that after the release it is unlikely that the **annual effective dose of any person from public** to exceed **10 μSv** and it is practically impossible to exceed **100 μSv** ;

VVR-S Reactor Decommissioning (4)

The release criteria under the authorization regime

The release may be:

- ✓ **unconditional** release: the materials may be subsequently used without any restriction.
- ✓ **conditional** release: the materials may be recycled/reused only according to the clearance conditions.

The release levels refer to the mass activity concentration and to the surface contamination.

The materials which **meet the exemption requirements** provided under the Annex 2 of Radiological Safety Fundamentals Norms, may be released **unconditionally** .

VVR-S Reactor Decommissioning (5)

The release criteria under the authorization regime

The solid materials which do **not meet exemption requirements** provided under the Annex 2 of Radiological Safety Fundamentals Norms may be released **unconditionally** only if the holder of authorization (IFIN-HH) gets in advance the following:

a) authorization issued by Ministry of Health according to the art. 38 paragraph (2) of Law 111/1996;

b) approval issued by CNCAN for use of obtained values as released levels for the respective materials, according to the provisions of Annex 2 of these norms.

If there are **not fulfilled** the release conditions, the **decontamination** activities will be performed till these conditions will be reached.

VVR-S Reactor Decommissioning (6)

The release criteria under the authorization regime

The **conditional** release levels as well as the release conditions are approved by CNCAN **case by case**, based on the proposal of the holder of authorization (IFIN-HH) which holds the materials:

- ✓ for **solid materials**, the levels of conditioned release are established whenever it is possible relaxation unconditional release levels (for instance in the case of the precise knowledge of a future destination of material or the small volume or surface of material);
- ✓ for the **liquid or gaseous materials**, other than the radioactive effluents, the levels of conditioned release should be established based on some conservative scenarios and only when the future destination of the respective materials is well known.

VVR-S Reactor Decommissioning (7)

The release criteria under the authorization regime

Verification of compliance with the release levels, by the holder of authorization, is done using the following methods, as appropriate:

- ✓ **direct measurements** of materials to be cleared
- ✓ **laboratory measurements** on the representative samples of materials to be cleared
- ✓ use of **scaling factors** properly derived
- ✓ **other methods** accepted by CNCAN

VVR-S Reactor Decommissioning (8)

The release criteria under the authorization regime

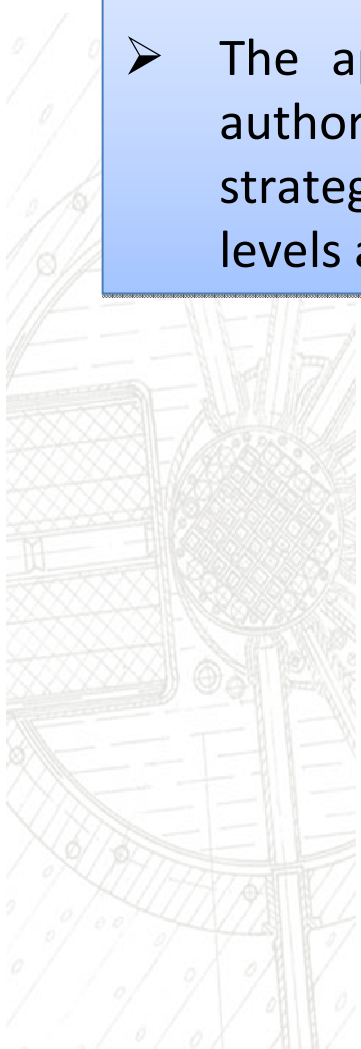
The measurement strategy shall comprise at least the following steps:

- ✓ **grouping of materials** to be measured such that in order to assure the homogeneity of the radionuclides spectrum
- ✓ **assessment of radionuclides** spectrum for the materials to be cleared by sample analyses, taking into account all pertinent information about the operational history of the materials
- ✓ choosing of the **suitable measurements method** in order to demonstrate the observance of the clearance levels
- ✓ choosing of the **suitable measurement instruments** and their appropriated calibration
- ✓ establishing of the appropriate measurement, recording and reporting

VVR-S Reactor Decommissioning (10)

The release criteria under the authorization regime

- The release may be performed only after it was approved by CNCAN.
- The approval of release is issued by CNCAN only if the holder of authorization has demonstrated that the measurement methods, strategy, instruments and procedures used guarantee that the release levels are fulfilled.



VVR-S Reactor Decommissioning (11)

The release criteria under the authorization regime

The criteria for recycling and reusing of solid waste, proposed by IFIN-HH are the followings:

- for materials with **simple geometry**, in case when measuring with the portable α , β and γ radiations monitor, the contamination of 0.4 Bq/cm² for β and γ radiation emitters occurs and 0.04 Bq/cm² for α radiation emitters, then these materials can be simply reused or remelted;
- for **homogeneous materials** from composition point of view (for example, concrete scraps obtained from scarifying), γ measurements for 220 l drum are performed or statistically sampling will be made after homogenization of the scraps and then measurements will be performed. Based upon such measurements, it has to be either used for back filling or disposed as industrial waste;

VVR-S Reactor Decommissioning (12)

The release criteria under the authorization regime

-for the materials with **complex/heterogeneous geometry** (for example, ducts, pipes contaminated inside, pumps, valves and other components in the primary circuit), the procedure is the following:

- contamination with β emitting isotopes (Bq/cm^2) will be measured with surface β -contaminant meter;

- HPGe spectrometry for 220 l drums is applied;

- specific activity for each contaminant, γ radiation emitter is determined by γ global measurements using a detector with scintillation for samples or for 1/10 of the 220 l drum volume.

- Based on the results of the measurements, the metals are sent again for decontamination if it is necessary, then they will be remeasured and categorized as non radioactive or radioactive materials.

VVR-S Reactor Decommissioning (12)

The release criteria under the authorization regime

Examples of release levels:

1. Soil release :

- ✓ Non-sealed ground (with vegetation):
Co60: 0.03 Bq/cm²
Cs137: 0.06 Bq/cm²
- ✓ Sealed soil (asphalt, concrete):
Co60: 0.2 Bq/cm²
Cs137: 0.4 Bq/cm²
- ✓ The surface measured will be 6 m², 100 m², or 1,000 m² based of degree of contamination

VVR-S Reactor Decommissioning (13)

The release criteria under the authorization regime

Examples of exclusion and exception levels:

Nuclenul	Nivelul de excludere (Bq/kg sau Bq)	Nivelul de contaminare (Bq/cm ²)	Nivelul de exceptare (Bq/g)	Nivelul de exceptare (Bq)
1	2	3	4	5
H-3	2 E+05	1000	1 E+06	1 E+09
Be-7	4 E+05	1000	1 E+03	1 E+07
C-14	2 E+04	30	1 E+04	1 E+07
O-15	-	3	1 E+02	1 E+09
F-18	1 E+04	3	1 E+01	1 E+06
Na-22	3 E+03	3	1 E+01	1 E+06
Na-24	1 E+04	3	1 E+01	1 E+05
Si-31	6 E+04	3	1 E+03	1 E+06
P-32	4 E+03	3	1 E+03	1 E+05
P-33	4 E+04	10	1 E+05	1 E+08
S-35	4 E+04	30	1 E+05	1 E+08
Cl-36	1 E+04	3	1 E+04	1 E+06
Cl-38	1 E+04	3	1 E+01	1 E+05
Ar-37	-	1000	1 E+06	1 E+08
Ar-41	-	3	1 E+02	1 E+09
K-40	2 E+03	3	1 E+02	1 E+06
K-42	2 E+04	3	1 E+02	1 E+06

K-42	2 E+04	3	1 E+02	1 E+06
K-43	1 E+04	3	1 E+01	1 E+06
Ca-45	1 E+04	10	1 E+04	1 E+07
Ca-47	6 E+03	3	1 E+01	1 E+06
Sc-46	7 E+03	3	1 E+01	1 E+06
Sc-47	2 E+04	3	1 E+02	1 E+06
Sc-48	5 E+03	3	1 E+01	1 E+05
V-48	5 E+03	3	1 E+01	1 E+05
Cr-51	3 E+05	100	1 E+03	1 E+07
Mn-51	1 E+04	3	1 E+01	1 E+05
Mn-52	6 E+03	10	1 E+01	1 E+05
Mn-52m	1 E+04	3	1 E+01	1 E+05
Mn-53	3 E+05	1000	1 E+04	1 E+09
Mn-54	1 E+04	100	1 E+01	1 E+06
Mn-56	1 E+04	3	1 E+01	1 E+05
Fe-52	7 E+03	3	1 E+01	1 E+06
Fe-55	3 E+04	300	1 E+04	1 E+06
Fe-59	6 E+03	3	1 E+01	1 E+06
Co-55	9 E+03	3	1 E+01	1 E+06
Co-56	4 E+03	10	1 E+01	1 E+05
Co-57	5 E+04	100	1 E+02	1 E+06
Co-58	1 E+04	30	1 E+01	1 E+06
Co-58m	3 E+05	1000	1 E+04	1 E+07
Co-60	1 E+03	3	1 E+01	1 E+05

VVR-S Reactor Decommissioning (14)

The release criteria under the authorization regime

Practice applied by CNCAN for approving clearance:

- ✓ Licensee applies for clearance and submits to CNCAN procedure for clearance.
- ✓ The procedure have to detail how are fulfil the requirements of the clearance regulations.
- ✓ CNCAN approves the procedure (or makes comments) .
- ✓ Licensee applies for effective remove of materials- description of materials, history, measurements, etc).
- ✓ CNCAN controls the records, and grants the written approval .