Integrated Management System in National Center of Nuclear Research (NCNR) - how it help to secure safety work and nuclear materials

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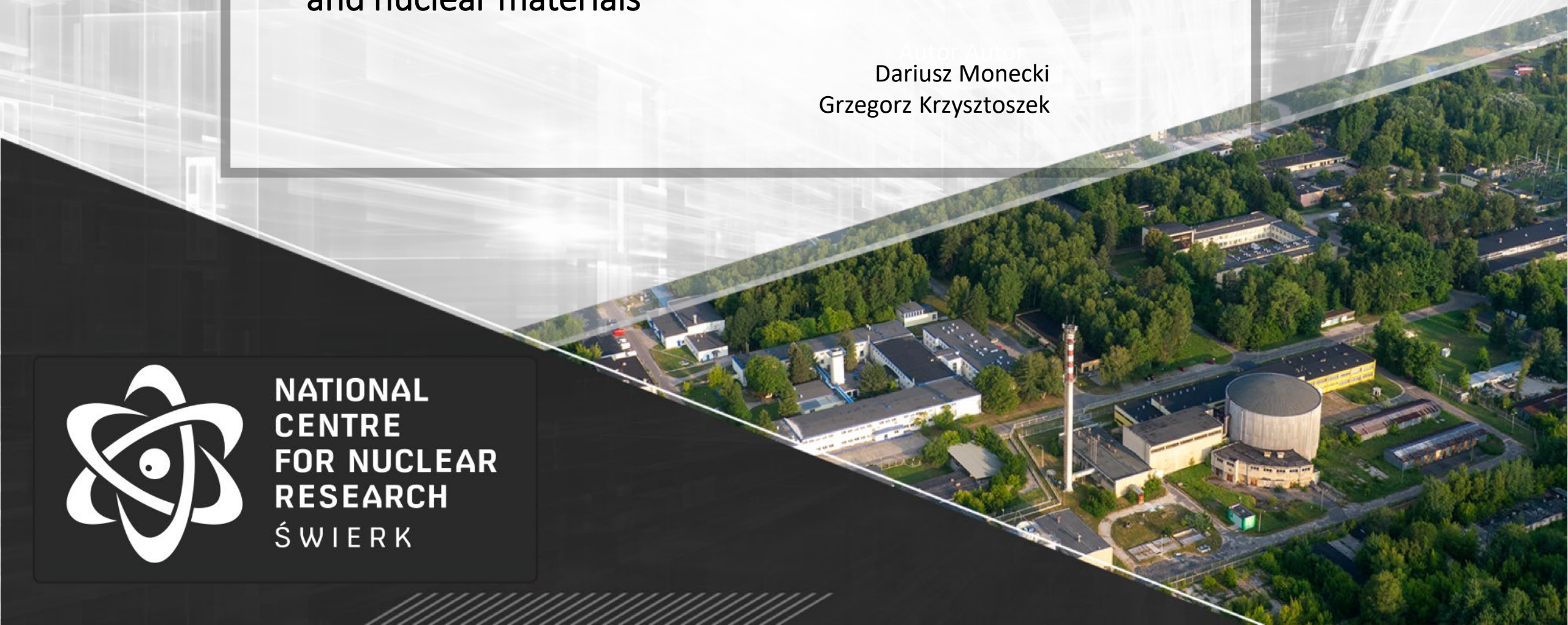

NATIONAL CENTRE FOR NUCLEAR RESEARCH
ŚWIERK


National Centre of Nuclear Research
at Swierk
30 km from Warsaw
44 ha area
Reactor MARIA

National Centre of Nuclear Research – who we are?

The National Centre for Nuclear Research is a unique research institution in Poland. It collaborates with leading scientific and research organizations worldwide. The Centre has a rich history and, above all, significant scientific achievements, particularly in the fields of physics, nuclear technology, and plasma technology. It conducts both basic and applied research in nuclear energy and various areas of subatomic physics and related disciplines.

Our work is interdisciplinary and spans the following scientific fields: physics, materials engineering, automation, electronics and space technologies, environmental engineering, mining and energy, and pharmaceutical sciences

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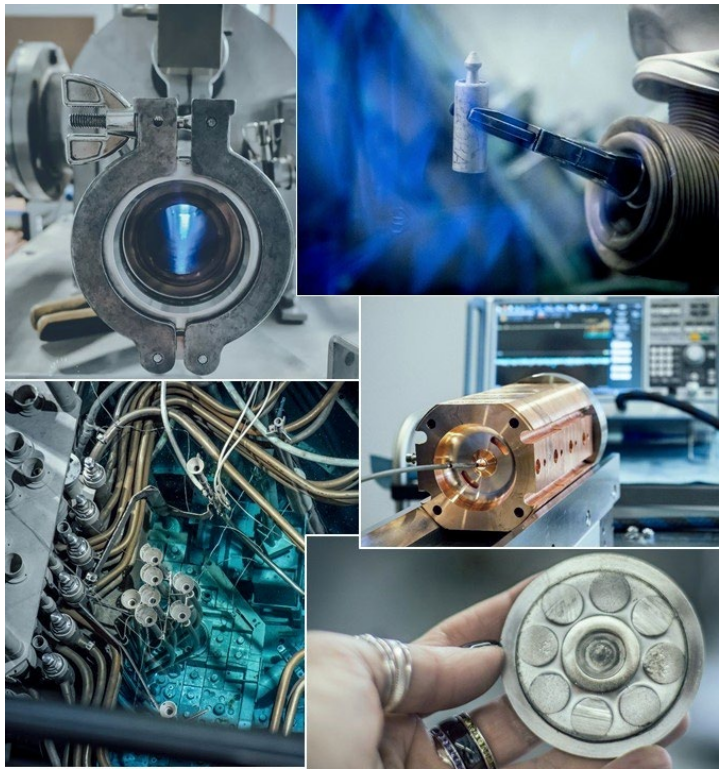


What about the reactor

The MARIA research nuclear reactor is the only operational nuclear reactor in Poland. Its power is 30 MW. Its construction began in June 1970 and it was launched in December 1974, at the then Institute for Nuclear Research (IBJ).

The MARIA reactor is used for:

- irradiation of target materials for the production of radioisotopes,
- material and technological research,
- neutron doping of semiconductor materials,
- neutron modification of materials,
- physical and neutron graphic research,
- use of neutron beams for medical purposes,
- training purposes in the field of physics and reactor technology.

The main nuclear facility in the NCNR – MARIA Research Reactor

1974 Dec 18th	The first criticality
1985	MARIA shut down for major upgrade (including enlargement of beryllium matrix, inspection of the graphite blocks, upgrade of the cooling/ventilation/temperature control systems)
1992 Dec	MARIA put again in operation
1993 – till now	Regular operations of the MARIA reactor
1996-2002	The second step of upgrading the technological systems in MARIA reactor (during regular maintenance periods)
2009-2010	Developing of technology of HEU targets irradiation for moly production based on AREVA-CERCA, MC type fuel

The main nuclear facility in the NCBJ – MARIA Research Reactor

2009-2014	Conversion of MARIA reactor core from HEU to LEU fuel
2015	New license for the next 10 years of reactor operation
2016	Final spent fuel MR type repatriation to Mayak, RF
2017 July	Delivery of MR-6 type LEU fuel from Russian Federation
2017 Dec.	The first irradiation of LEU targets for Mo production
2019-2020	Exchange of beryllium blocks
2022-2024	- delivery of fuel MC type from Framatome - upgrading of power supply system - exchange of primary cooling circuits water tanks - upgrading of control room

Main modifications of reactor installation

The reactor is undergoing continuous modifications aimed at improving its safety and functionality in line with its operational program. The most significant changes concern nuclear fuel. Initially, the MARIA reactor used fuel enriched to 80% in the isotope U-235. In 2000, fuel enriched to 36% was introduced, and in September 2012, tests began with fuel enriched to less than 20%. That same year, the cooling tower was modernized.

In 2014, the conversion of the reactor to low-enriched fuel was completed. This change was accompanied by an upgrade of the fuel channel cooling circuit: the main circulation pumps were replaced, and new post-shutdown pumps were installed. In the same year, the export of spent fuel elements to the Russian Federation was completed as part of the international Global Threat Reduction Initiative (GTRI), under the auspices of the U.S. Department of Energy and the International Atomic Energy Agency.

In 2023, the first stage of a major reactor modernization was carried out. Currently, the MARIA reactor is in the process of obtaining a new operating permit (the previous one expired at the end of March 2025). Thanks to ongoing modernization efforts, it is expected to operate until 2053.

Polish law –> Act of Atomic Law

INTEGRATED MANAGEMENT SYSTEM

– A Management System encompassing elements related to safety, health, environment, quality assurance, economic issues and physical security, giving priority to nuclear safety by ensuring that all decisions are made after analysis of their impact on nuclear safety, radiological protection, physical protection and nuclear material safeguards.

NUCLEAR SAFETY

– achieving appropriate operating conditions, preventing accidents and mitigating their effects, resulting in the protection of workers and the public from threats resulting from ionizing radiation from nuclear facilities

Polish law –> Act of Atomic Law

The integrated management system includes:

1) quality policy;
2) quality assurance program;
3) description of the management system;
4) description of the organizational structure;
5) description of responsibilities, obligations, authorities and mutual interactions in the areas of management, implementation and assessment;
6) description of mutual interactions with external entities;
7) description of processes occurring in the organizational unit together with supporting information explaining how the preparation, review, execution, documentation, assessment and improvement of activities are carried out;
8) adopted safety classification of systems and elements of construction and equipment of the nuclear facility;
9) preliminary safety report or facility safety report;
10) safety culture policy, understood as a jointly established and implemented commitment of management and employees, ensuring the practical functioning of safety culture in the organizational unit.

Integrated Management System Policy

In order to confirm the management's commitment of the integrated management system to its implementation, a IMS policy was prepared where it is clearly declared:

The National Centre for Nuclear Research, in addition to scientific research, conducts activities in which the priority is the operation of the MARIA reactor, among others for the production of radiopharmaceuticals for diagnostics and therapy (mainly oncological). **The basis of this activity is to ensure nuclear safety and radiological protection of people and the environment, physical protection of nuclear materials, promotion of safety culture, ensuring appropriate health and safety conditions and care for the environment during its implementation.**

All employees are obliged to apply it in practice.

Integrated Management System (IMS) in NCNR

For the purposes of this system, it has been assumed that ensuring safety during the operation of a nuclear facility consists of the following elements:

- nuclear safety, understood as in the definition given in the previously slide,

- radiological protection,

- physical protection,

- securing nuclear materials,

- occupational health and safety,

- economic security.

Integrated Management System (IMS) in NCNR

The activities of the NCNR are managed by the Director, who is appointed by the minister overseeing the Institute. The Scientific Council and the Nuclear Safety Commission serve as advisory bodies to the Director.

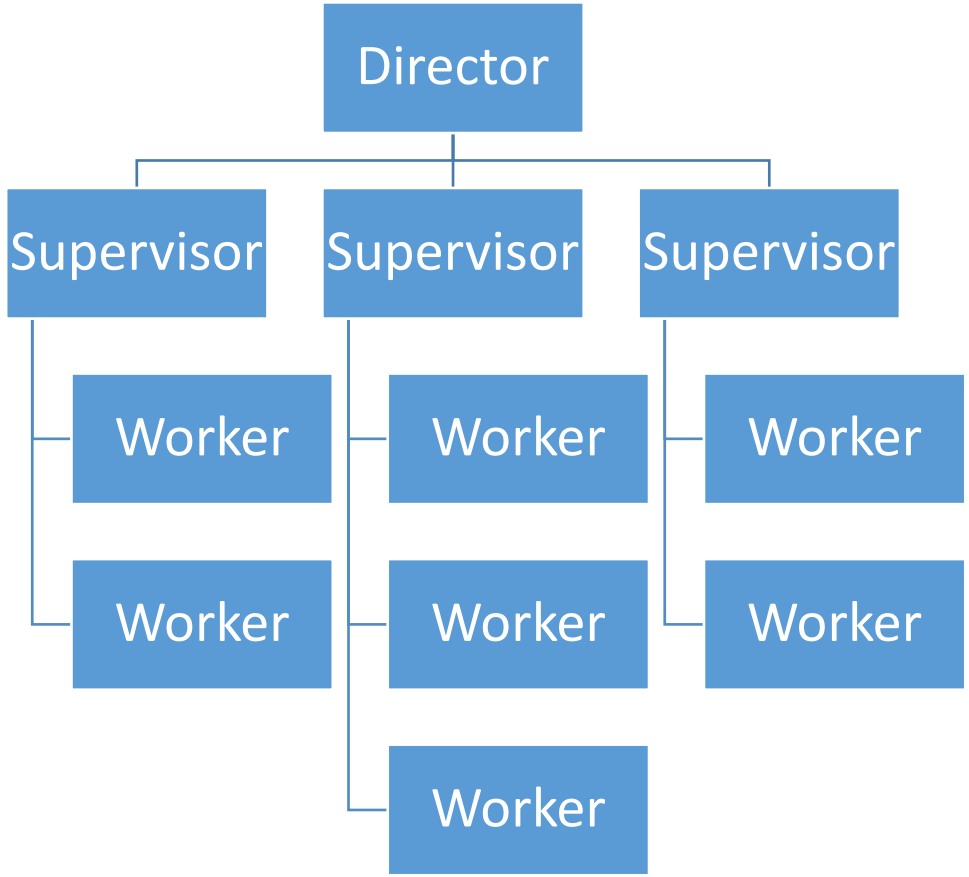
The scope of the Commission's activities includes, in particular:

- assessing the nuclear safety documentation of nuclear facilities at the NCNR during the design, construction, operation, and decommissioning phases;
- reviewing reports on routine radionuclide releases into the environment;
- evaluating reports on ionizing radiation doses received by personnel operating nuclear facilities and by the general public;
- assessing reports submitted to nuclear regulatory authorities;
- reviewing technological installations, experimental devices, and new reactor technologies (e.g., probes, loops, pneumatic tubes, horizontal channels) from the perspective of nuclear safety and radiological protection;
- analyzing past nuclear accidents or events, as well as potential threats that could lead to such incidents;
- initiating projects aimed at improving the current state of nuclear safety and radiological protection.

Integrated Management System (IMS) in NCNR

In NCNR, the principle is one-person management, according to which the organizational unit is headed by one manager, and each employee reports to only one superior, to whom they are responsible for performing their duties and the official orders received.

An employee who has received an official order directly from a higher-level superior, should carry it out, notifying their immediate superior about this order - if possible before carrying it out.



Management System Documentation

The basic documents describing the Management System implemented in NCNR are:

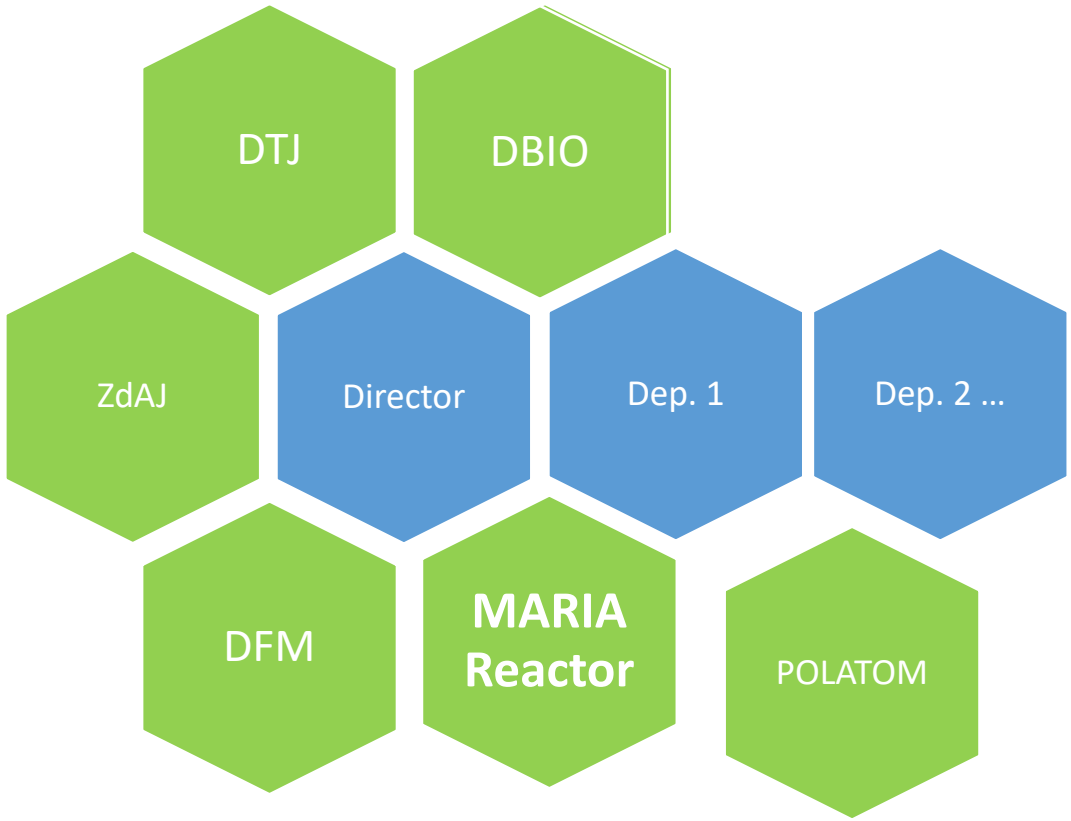
- Integrated Management System Book
- NCNR Organizational Regulations

Within the Integrated Management System, general procedures have been created, which are elements of this system. They include:

- Procedure Supervision of Integrated Management System documents
- Procedure Management Review
- Procedure Internal Audits
- Procedure Corrective and Preventive Actions
- Procedure Identification of Regulations

The Director of the Institute, as part of managing the work of the National Center for Nuclear Research, issues Director's Orders, which are published on the internal intranet available to NCNR employees

NCNR Structure - more than 1,100 people are employed



DBIO – Department of Nuclear Safety and Security (Dosimetric Measurements Laboratory)

DTJ – Department of Nuclear Techniques and Equipment

ZdAJ – Nuclear Equipment Department Hitec

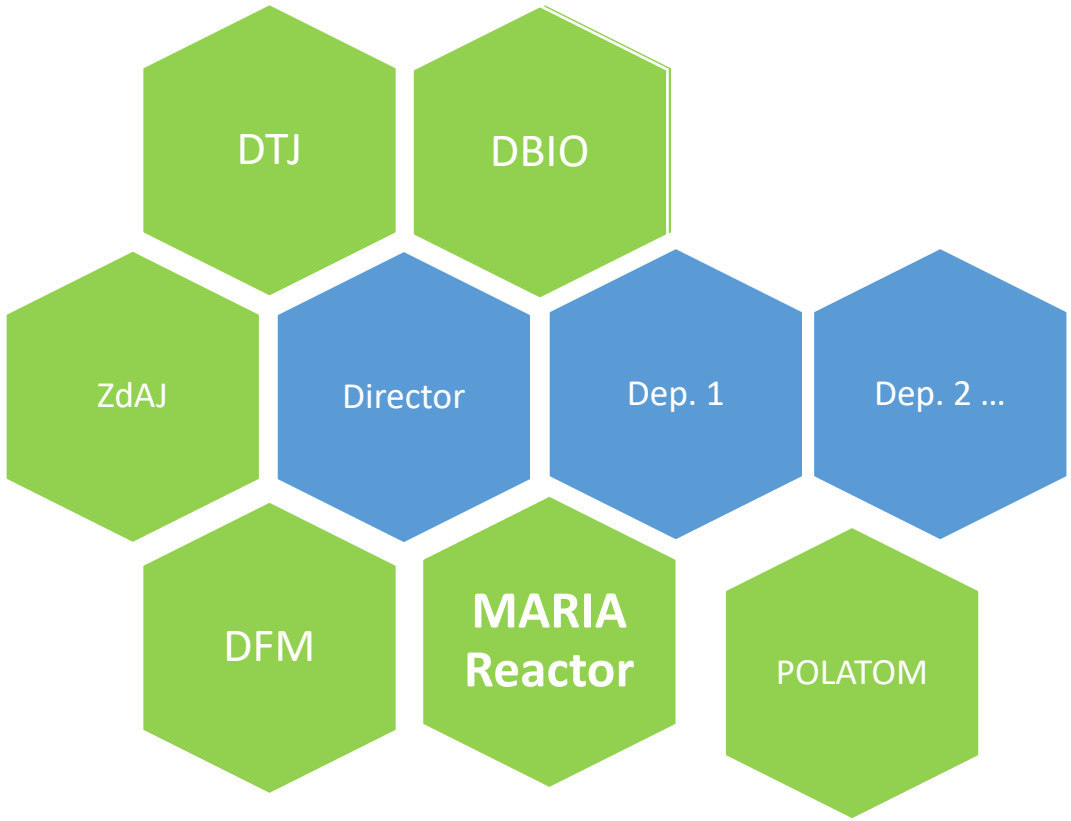
DFM – Department of Materials Physics (Materials Research Laboratory)

POLATOM - Radioisotope Center (medical)

Departments operating **with** exposure to ionizing radiation

Other departments operating **without** exposure to ionizing radiation

NCNR Structure



Integrated Management System Book covers all departments and sets out general principles that will be common to all

These departments can work according to different systems and establish their own rules for creating documentation, using good practices based on IMS Book.
They always require permission for their work form regulatory body.

IMS Processes

From a nuclear safety perspective, a group of processes has been identified as having a significant impact in this area. In total, we have 26 distinct processes

Management	Operational	Auxiliary
Management	MARIA reactor operation	WSO and protection of classified information
Budget	MARIA reactor operation support	Fire Protection
IMS Improving	Education/ Training	Emergency procedures
	Nuclear safety supervision	
	Physical protection on nuclear materials and facilities	
	Radiological monitoring	
	Spent fuel management	
	Radioactive waste management from MARIA	

Processes – how they are described in the IMS Book?

Each of them has:

- Assigned owner
- The purpose of the process
- Scope of the process
- Input data to the process
- Process output
- Responsibilities and rights of the implementers (positions, departments, plants) of the proces
- Description of procedural activities
- Process metrics

Processes – how they are evaluated?

Different level evaluation:

- Metrics monitoring by process owner
- Internal audit
- Yearly Management Review
- Audit by external body (e.g. national or international organization)
- Report of corrective or preventive actions from employees

The above activities allow us to assess whether the processes are managed properly and whether employees perform their work as expected. We place great emphasis on correct and clear documentation in order to exclude any uncertainty of operations that may lead to errors or dangerous situations

Safety Classification of Structures, Systems and Components of Nuclear Facility

In accordance with the IAEA (Safety Classification of Structures, Systems and Components in Nuclear Power Plants, IAEA Safety Standards Series No. SSG-30) assumption, a document SEKW was developed that identified and classified those reactor systems and devices that are necessary to protect people and the environment from ionizing radiation, taking into account their role in preventing an accident or in limiting the effects of an accident, if one occurs.

Safety Report

The reactor safety report is one of the fundamental documents required by the Atomic Law. It contains all the data necessary to assess the safety of a nuclear facility.
For the MARIA reactor, which is currently in the operational stage, a document titled **"Operational Safety Report for the MARIA Reactor"** (ERBM) has been developed. This report contains all the information required by the Regulation of the Council of Ministers on documents necessary when submitting an application for a permit to perform activities involving exposure to ionizing radiation or when reporting the performance of such activities.

Now this document is under final upgrading for new license.

Safety Culture in NCNR

The Institute strongly promotes attitudes and behaviors that enhance the level of safety culture, including:

- giving top priority to safety, as reflected in documentation, communication systems, and decision-making processes;
- preparing plans and budgets with full consideration of safety factors;
- management at all levels demonstrating safety-oriented attitudes and behaviors;
- the systematic development of competencies among both management and employees;
- fostering trust-based relationships between management and staff;
- conducting inspections and evaluations by external institutions;
- raising employee awareness that economic objectives are closely linked to the level of safety;
- clearly defining the rights and responsibilities of employees.

Human Factor Management Program

One aspect of safety culture is the implementation of a program for managing human factors that may impact the operation of a nuclear facility. The key elements of this program include:

- minimizing the potential for human error through proper design of the main control room—based on ergonomic principles and drawing on many years of operational experience;
- clearly separating operator-performed control and steering functions from the facility's automatic systems;
- defining the minimum number of shift personnel required to carry out the actions necessary to bring the facility to a safe shutdown state, along with a clear assignment of their respective roles;
- providing operators with comprehensive information that is both easy to understand and enables accurate, rapid assessment of the facility's condition in both normal and emergency situations;
- confirming automatically executed actions through safety and radiological protection systems, ensuring that all safety-related activities are performed reliably and safely;
- applying appropriate procedures during maintenance shutdowns, repairs, and when introducing any changes to the installation;
- ensuring proper employee training and systematically cultivating a strong safety culture;
- implementing operational procedures that uphold nuclear safety.

Human Factor Management Program

The possible influence of human factors should be taken into account in safety analyses by:

developing a comprehensive list of postulated initiating events (both internal and external), including potential human errors during normal operation of the nuclear facility, as well as external events caused by human activity

Periodic Safety Assessment

In accordance with Article 37e of the Atomic Law on the periodic assessment of the nuclear safety of a nuclear facility, it is mandatory to conduct a periodic safety assessment of a nuclear facility (hereinafter referred to as the "periodic safety assessment").

This assessment evaluates compliance with the permit, legal regulations, and both national and international nuclear safety standards. It also focuses on the safe operation of equipment, with particular emphasis on issues related to the ageing of devices, systems, structural elements, and equipment within the nuclear facility.

Two such assessments have been carried out so far. (2018 and 2024)

Thank you for your attention

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