



TVEL
ROSATOM



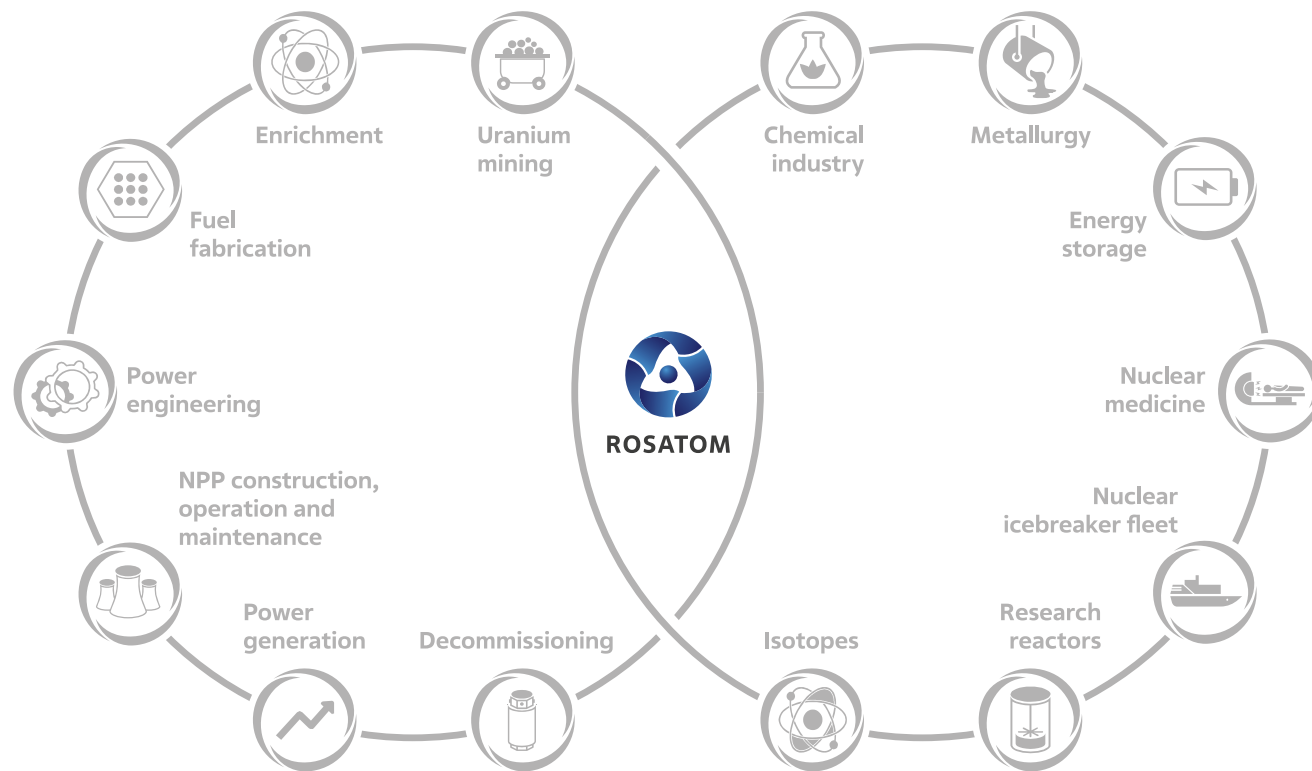
ROSATOM DECOMMISSIONING INTEGRATOR

State Atomic Energy Corporation Rosatom

State Atomic Energy Corporation Rosatom is a vertically integrated holding company involved in all process steps of nuclear power industry, including geological exploration and mining of uranium, uranium conversion and enrichment, nuclear fuel fabrication, mechanical engineering, nuclear power plant (NPP) design and construction, decommissioning, spent fuel and radioactive waste management.

World-class competencies in the nuclear industry enable ROSATOM to diversify into related business segments, such as wind power, nuclear medicine, advanced materials and technologies, digital products, infrastructure solutions, additive technologies and energy storage systems, process control systems and electrical engineering, environmental solutions, etc.

ROSATOM is over 300 enterprises and organizations, including research centers and the world's only nuclear-powered icebreaker fleet. It is the biggest electric power producer in Russia, and one of the world leaders in nuclear technologies (NPP construction, uranium enrichment services, nuclear fuel fabrication, etc.). It constructs and operates many large-scale projects outside of Russia.



300

enterprises and organizations

250,000

people employed in the State Corporation

19,7 %

share of electricity generated by nuclear power plants in Russia

\$ 26 bn

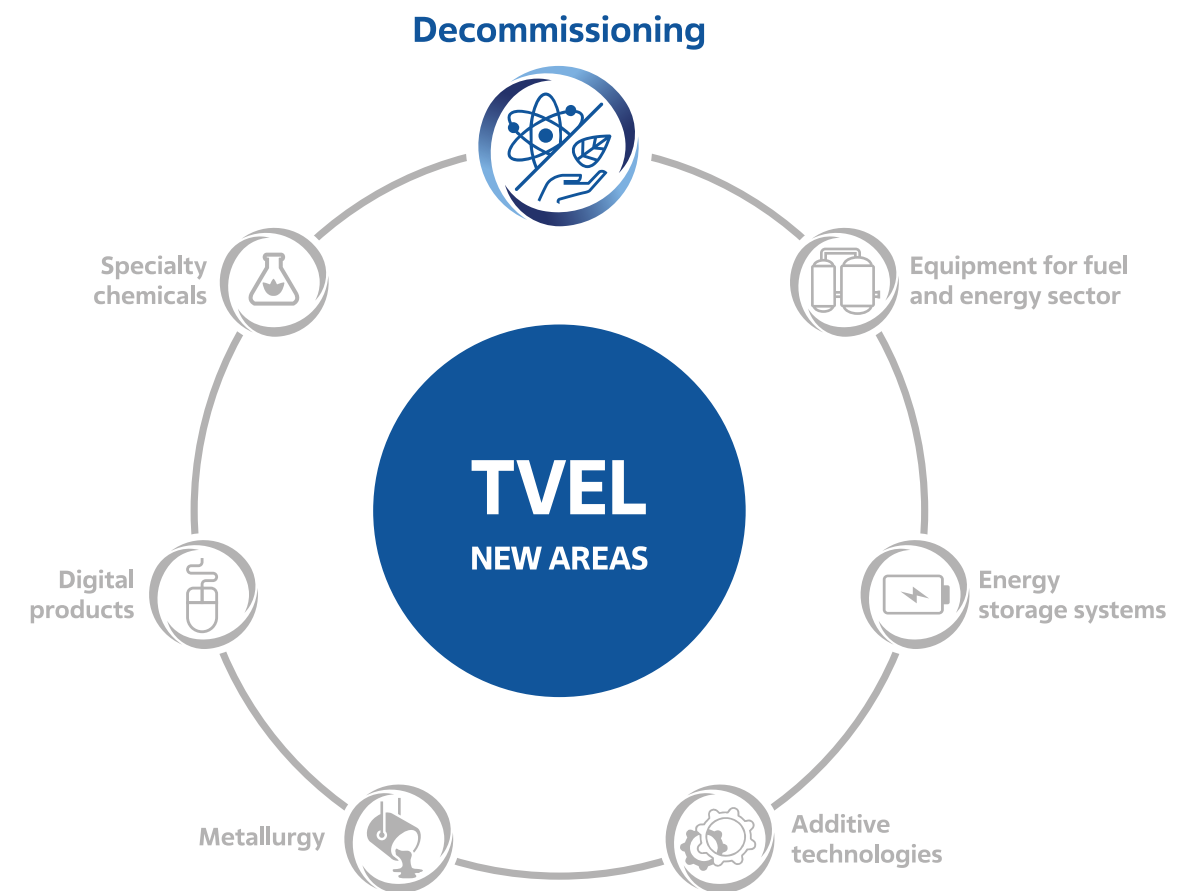
portfolio of new products

TVEL Fuel Company of Rosatom

The TVEL Fuel Company of Rosatom is one of the world's largest nuclear fuel producers. TVEL is a monopoly supplier of nuclear fuel for all Russian nuclear power plants, as well as marine and research reactors in Russia. TVEL also provides fuel for nuclear power plants in 15 countries; every 6th power reactor in the world uses fuel from TVEL.

TVEL includes enterprises specializing in the production of gas centrifuges, uranium enrichment and nuclear fuel fabrication, as well as research and development organizations.

Within Rosatom, TVEL is actively developing new business areas, such as decommissioning of various facilities, digital and additive technologies, metallurgy, energy storage, as well as equipment for the fuel, energy and chemical industries.



10

production sites

22,800

people employed in TVEL

17 %

of global nuclear fuel fabrication market

\$ 340 m

revenue from new products

ROSATOM DECOMMISSIONING INTEGRATOR

**Centralized development
and solution of on-going
problems on decommissioning
and radioactive waste management**

TVEL has been an integrator of the Russian nuclear industry in the area of Decommissioning of Nuclear and Radiation Hazardous Facilities and Management of Associated Radioactive Waste since 2019. The Integrator's activities also include maintenance of the NPP reactor units, including the primary circuit internals.

As a decommissioning integrator TVEL:

-  Ensures human and environmental safety
-  Builds up and consolidates the competencies of nuclear industry organizations
-  Forms a comprehensive solution for clients
-  Promotes internal cooperation
-  Creates educational platforms
-  Develops supply chains in Russian and global markets
-  Acts as a single customer for R&D on decommissioning of nuclear and radiation hazardous facilities
-  Contributes to the achievement of the UN Sustainable Development Goals



WORLDWIDE PRESENCE AND MAJOR CURRENT PROJECTS

20
countries
of presence

100+
completed
projects

50+
years of technological
experience

Dismantling of 4 reactor pressure vessels at Oskarshamn NPP and Barsebäck NPP

Uniper
2019-2024, Sweden

Waste treatment plants for Khmelnytsky NPP

NAEK
2018-2020, Ukraine

Evaporator for waste treatment

ITM
2021-2022, Germany

Solidification unit

Intecsa
2016-2020, Spain

Upgrade of the nuclear incineration facility

Eng. Seibersdorf
2016-2018, Austria

Construction of Phase 1 of the National Disposal Facility

SERAW
2016-2021, Bulgaria

Waste treatment plants for Akkuyu NPP

NIKIMT-Atomstroy
2020-2022, Russia/Turkey

Construction of disposal site for special radioactive waste in B-25 basin of CSP JSC

FEDERAL PROGRAM
2016-2020, Seversk, Russia

Decommissioning project of radiochemical plant of SCP JSC

FEDERAL PROGRAM
2019-2022, Seversk, Russia

Construction of disposal site for special radioactive waste in B-1 basin of CSP JSC

FEDERAL PROGRAM
2011-2020, Seversk, Russia

Decommissioning of buildings 802 and 804, as well as warehouse 35

FEDERAL PROGRAM
2016-2030, Angarsk, Russia

Decommissioning of structures 310 at AECJ JSC

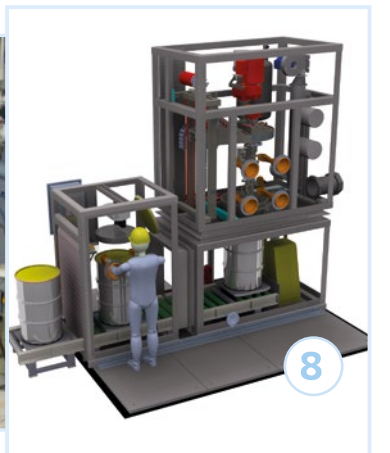
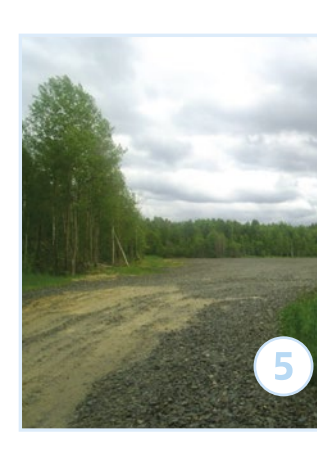
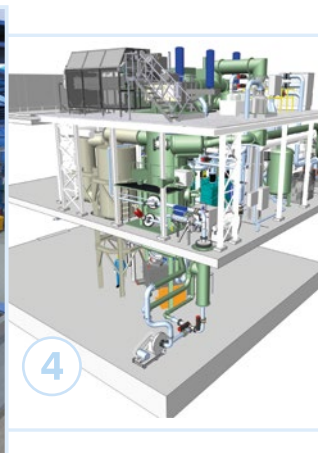
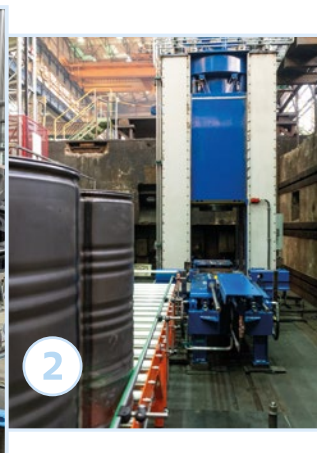
FEDERAL PROGRAM
2021-2025, Angarsk, Russia

Zhangzhou spent resin treatment equipment

AEROSUN
2021-2022, China

Waste treatment plants for Xiapy NPP

CASHH
2018-2024, China



COMPLETED PROJECTS TVEL JSC IN RUSSIA



2010

Decommissioning of nuclear facility KhMP to the green field, (Krasnoyarsk)



2012

Disposal of special RAW, pool B-2, (Seversk)



2015

Bochvar Institute, building B decommissioning to greenfield status (Moscow)



2015

ChMP, building 7 decommissioning to greenfield status (Chepetsk)



2015

Disposal of special RAW on site of EI-2 Reactor, (Seversk)



2017

Bochvar institute Removal of nuclear facility in building 53 without demolition (Moscow)



2019

Disposal of special RAW, pool B-1, (Seversk)



2019

Construction of 7 disposal facilities of solid RAW (Seversk)



2018

NCCP PJSC, 3 buildings decommissioning to greenfield status (Novosibirsk)



2018

ChMZ JSC, Building decommissioning without demolition (Chepetsk)



2018

Centrotech-SPb JSC, Radiation source decommissioning without demolition of building (St. Petersburg)



2018

NCCP PJSC, building 17 decommissioning to greenfield status (Novosibirsk)



2017

NCCP PJSC, building 73 decommissioning to greenfield status (Novosibirsk)



2017

OKB-NN JSC, radiation source decommissioning without demolition of building (Nizhny Novgorod)



2019

SCP JSC, HEU-LEU facility decommissioning without building demolition (Seversk)



2019

AECJ JSC, building 804 decommissioning to greenfield status (Angarsk)



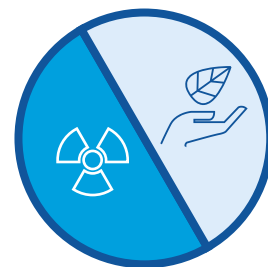
2019

NCCP PJSC, building 18 decommissioning without demolition (Novosibirsk)



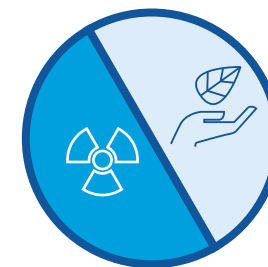
2019

SCP JSC, development of a digital engineering-radioactive model of radiochemical plant (Seversk)



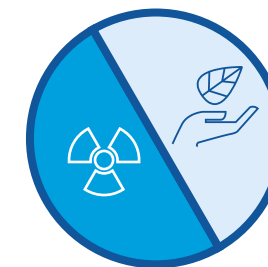
2020

Disposal of special RAW, pool B-25, (Seversk)



2021

ChMZ, geological and hydrological surveys of the aquifer of RAW storage (Chepetsk)

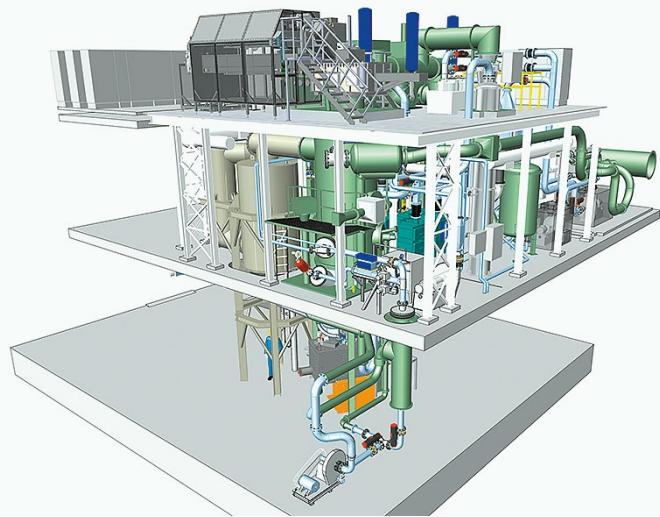


2021

Buildings 60A, 116A decommissioning to greenfield status (Moscow region)

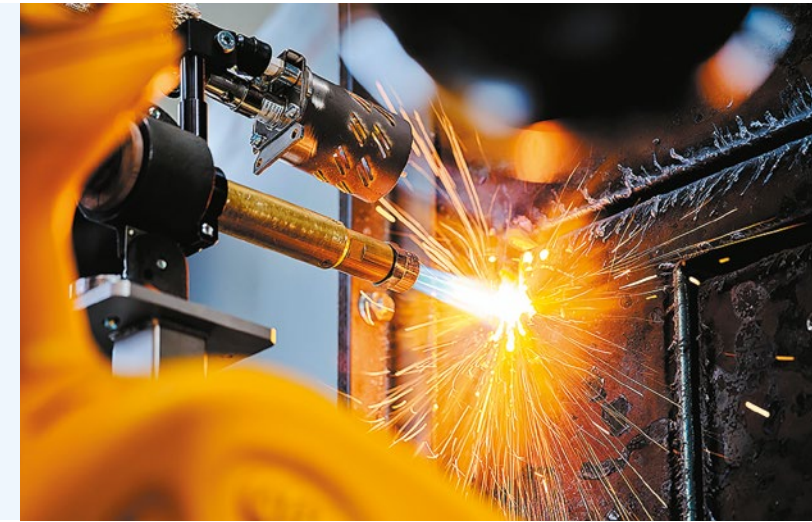


INTEGRATED OFFER



PREPARATION FOR DECOMMISSIONING

- Development of decommissioning concept and strategy
- Complex engineering and radiation mapping
- Decommissioning project development
- Preparation of license documents
- Obtaining the decommissioning license



DISMANTLING AND FRAGMENTATION

- Dismantling and fragmentation of reactor pressure vessels
- Fragmentation of RPV internals
- Dismantling of systems and components
- Dismantling of large equipment during decommissioning
- Demolition of building structures
- Re-purposing of facilities

CREATION OF DECOMMISSIONING INFRASTRUCTURE

- Liquid RAW process equipment
- Solid RAW treatment systems
- Solutions for decontamination of equipment and building structures
- Equipment for fragmentation of large-items



RAW MANAGEMENT

- Removal of accumulated solid RAW from storage facilities
- RAW sorting
- Processing and conditioning of solid RAW
- Processing and conditioning of liquid RAW
- RAW transportation
- Optimization of RAW processes



DECONTAMINATION

- Pre-dismantling decontamination
- Decontamination of dismantled equipment and segmented components
- Decontamination of building structures, buildings and associated facilities



REHABILITATION OF CONTAMINATED AREAS

- Land rehabilitation
- Land reclamation
- Site release from regulatory control

TECHNICAL SOLUTION

BELT CONVEYOR FREE RELEASE MEASUREMENT SYSTEM (FREMES-BM100)

Clearance of Bulk Materials (up to 100 to/hour) contaminated with an unknown amount of nuclides

FREMES

is a free release measurement system which provides automatic radiological characterisation of large amounts of potentially contaminated bulk materials (soil, construction materials, etc.) and sorting into optimised waste categories.

Purpose of FREMES	FREMES achieved benefits
<ul style="list-style-type: none"> • Radiological characterization of bulk material • Classification of contaminated bulk material • Subsequent segregation and consolidation of material • Generation of complex documentation and comparison to regulatory limits 	<ul style="list-style-type: none"> • No secondary waste generation • Precise examination of bulk material <ul style="list-style-type: none"> • Detection of high- and low energy gamma emitters • Detection of Alpha- and Beta-emitters • Verification of expected nuclide vector • Evaluation of spatial activity distribution by connection of radiological characterization with the excavation map • No need for process media • Proven toughness for construction site suitability • Volume reduction to minimise expensive disposal routes

Technical Data



100 tons
per hour maximum throughput



1000 kg
Batch size



3.6 Bq/kg
detection limit for U-235

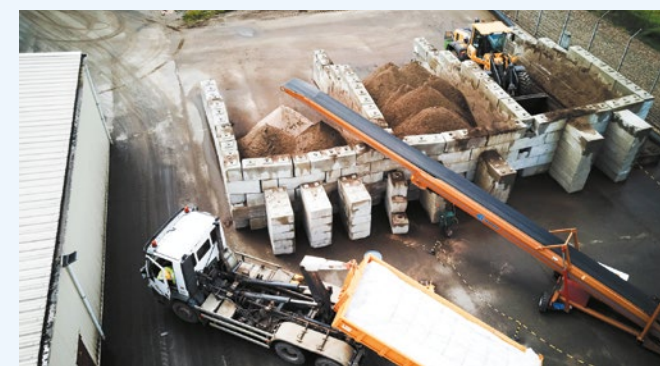
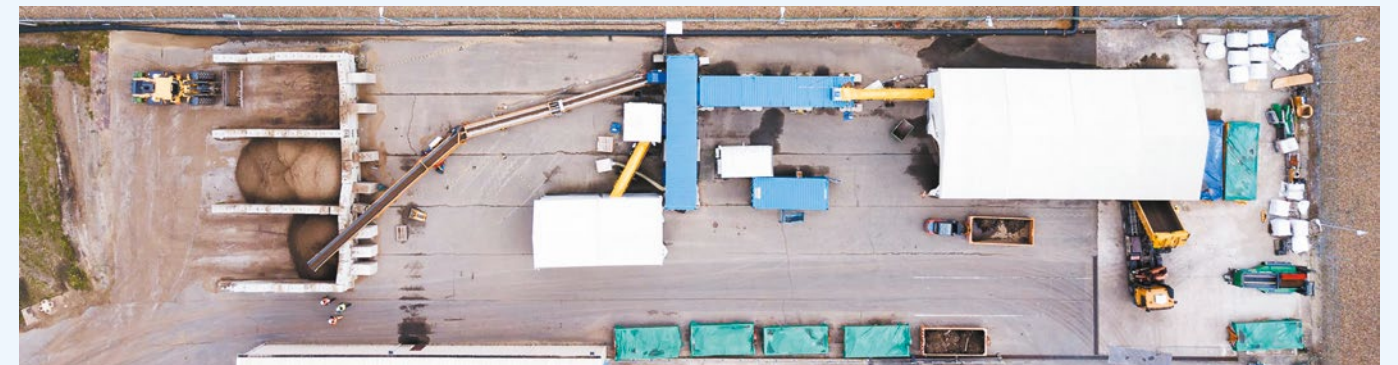
EXAMPLE PROJECT REFERENCE

A decommissioning project with FREMES-BM100 application was realised in 2020 at the former fuel element factory of FBFC International at Dessel, Belgium.

A pre-screening of the site and adjacent areas had been performed and an excavation plan was generated. Several thousand tons of soil had been prepared for further processing. Potentially suspect soil was excavated and analysed to ensure the absence of contamination. Due to the application of FREMES, 100% of the target material was characterised, and the amount of nuclear waste to be stored was subsequently minimised with all necessary records archived.

Advantages

- Reduction of contaminated soil volumes by 10x (around 90% of soil sorted goes for free release and was declassified) – The Belgian project characterized 45.150 tonnes of potentially contaminated soil. The clearance rate was 95% (less than 1 Bq/g).
- Time efficient solution enabling to significantly decrease the duration of land restoration projects
- Applicable for most wide-spread contaminations of land with detection on low activity levels (gamma-emitters Cs-137, Co-60 etc)

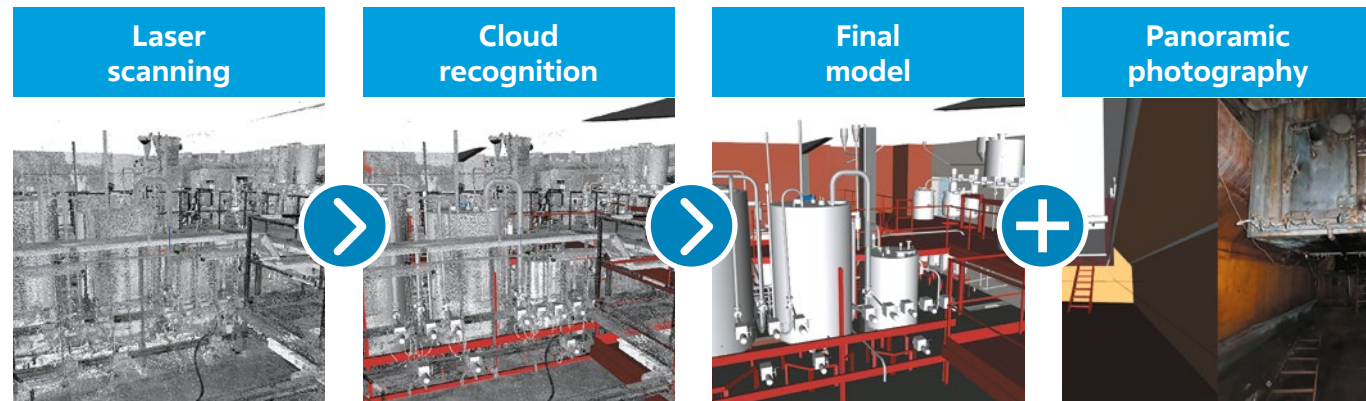


FOR MORE INFORMATION,
SCAN THE QR CODE



TECHNICAL SOLUTION

DIGITAL OPERATING RADIATION ENGINEERING MODEL (DOREM)



Application of the digital product “Digital Operating Engineering Radiation Model” (DOREM) provides a fundamentally new level for development of initial data corresponding to the actual state of the facility. This leads to an increased accuracy of results whilst reducing project staffing. It is based on the application of digital technologies with addition of laser scanning technology and creation of photo panoramas using a spherical photography method.

WHY DOREM?

Advantages of DOREM	Benefits at decommissioning preparation stage
<ul style="list-style-type: none"> • Unified Data Repository • Structured and inter-related information • Collaboration and interaction optimization • Digital tools for analysis, management and control 	<ul style="list-style-type: none"> • Up-to-date drawing documentation • Improving the accuracy of RAW generation volume assessment • Minimizing design errors • Selection of the safest decommissioning technology

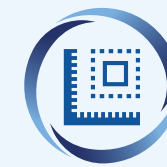
DOREM makes it possible to prepare calculations within the project framework taking into account statistical data, includes the possibility of variant calculations of radiation field dynamics, various approaches to dismantling equipment and building structures, RAW management, etc.

All of this allows for reduction of the time and total costs of decommissioning projects

REFERENCE PROJECT EXAMPLE

DOREM was developed within a complex engineering and radiation examination of the production site for irradiated standard uranium block (ISUB) processing at the Radiochemical Plant of SCP JSC in Seversk, Russia.

The digital model of the DOREM project considers an area of 865,000 m², incl. 10 buildings, and 7 tunnels with a total length of 882 m, and also 10 overpasses with a length of more than 2,000 m. The volumes of low, medium and very low level radioactive waste were calculated. All activities were completed in 90 days. The ISUB site DOREM creation project involved 95 people. The project was implemented in 2019.



865,000 m²
total project area



90 days
work duration

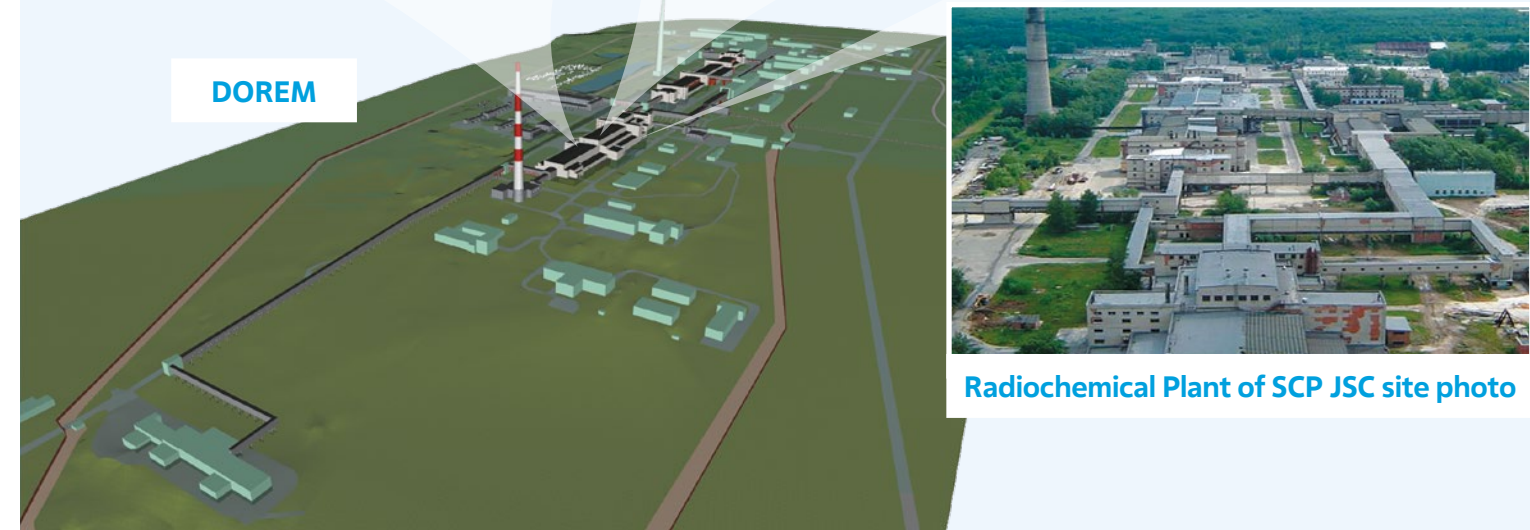


2014
laser scanning points



3066
panoramic photos

Specifications	Drawings	RW volumes



Radiochemical Plant of SCP JSC site photo

TECHNICAL SOLUTIONS FOR INDUSTRY



For more information, scan the BY QR CODE:



Metallic RAW Decontamination Technology

Purpose: dismantled equipment decontamination, flushing of dismantled pipework

Features:

- metal waste decontamination using liquids
- washing of assembled separation production facility pipework
- disassembly of separation production facility pipework using plasma cutting



Torso-type Robotic Manipulator for RAW Management and NRHF decommissioning

Purpose: performance of technological operations in the sphere of RAW management and nuclear- and radiation-hazardous facilities (NRHF) decommissioning

Features:

- safe handling of ionising radiation sources during RAW management and NRHF decommissioning
- application availability when handling harmful and toxic substances
- ability to use in high-radiation environments

Technology for Processing Spent Ion Exchange Resins (SIER)

Purpose: dehydration and heat treatment of LRW containing suspended particles of ion-exchange resin mixtures; obtaining their dry micro-encapsulated mixture with quartz sand for further disposal

Features:

- the method of settling the initial resin mixture suspension with subsequent drying and heat treatment of the solid phase is used
- SIERS are encapsulated to a state that eliminates the absorption of moisture
- combustion products are neutralized in acid-base absorbers



Long-length nuclear reactor components segmenting plant

Purpose: fragmentation of CSS rods, casings, metal structures of a nuclear reactor under water in spent fuel pools

Features:

- mechanical or thermal fragmentation methods
- use of radiation-resistant video equipment for process control
- remote operation
- the possibility of replacing the manipulator working body
- work with VLLW, LLW, HLW types of wastes

LRW vitrification unit based on an induction melter

Purpose: vitrification of radioactive waste to produce a glass block for subsequent long-term storage or disposal.

Features:

- small equipment dimensions (modular design)
- continuous and batch operation modes
- Remote process monitoring and control, remote replacement of damaged equipment.



Laser Complex for Equipment Fragmentation with Aerosol Monitoring System

Purpose: segmentation of reactor internal and VVER-210/365/440 reactor pressure vessels and other NPP equipment.

Features:

- dismantling of large reinforced concrete and metal structures
- Possibility of gaseous diffusion and other NPP equipment dismantling
- cutting spatial metal structures up to 440 mm thick

INDUSTRY INTEGRATOR

For your notes

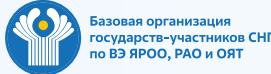



Innovative solutions

- Complex robotic systems
- digital technologies
- R&D projects



WORLD NUCLEAR ASSOCIATION




Базовая организация государств-участников СНГ по ВЭ ЯРОО, РАО и ОРТ



International partnership

- respected international partner
- excellent reputation in the expert environment

Driver of sustainable development in the nuclear industry

- Consideration of D&D solutions during NPP construction
- support to Governments and Companies in solving D&D problems and RAW management issues.



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TVEL

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