РОСАТОМ

Atomexpo-2015

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

SNF management system in Russia

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Russian NPP on the map

Russia operates 34 nuclear power units with the installed capacity of 25.2 GW

LONG-TERM PLANNING : one-time large-scale construction of 9 units
Commissioning of 16 units in 2020, and 38 units in 2030

What is

Spent Nuclear Fuel: waste or resource?

96% of the material contained in Spent Nuclear Fuel is recyclable

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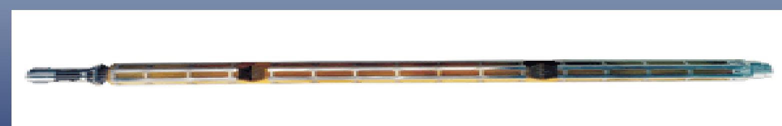
VVER-1000/1200

1 fuel assembly ~500 kg of Uranium before irradiation in the reactor



After irradiation

Recyclable material **Waste**

1% 5 kg - Pu

U - 475 to 480 kg (95 to 96%)

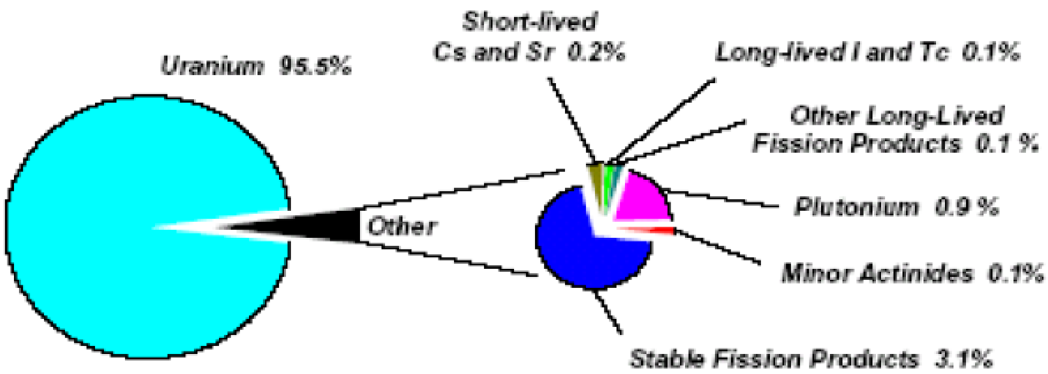
FP/MA 15 to20 kg (3 to 4 %with 0.1%MA)

98.97 % of radiation dose rate

Spent fuel and radiotoxicity (1)

the harmful effect of chemical substances as a result of their content of radioactive elements in various concentrations. The effect of ionizing radiation emitted by the elements leads to changes in the metabolism and structure of living organisms.

Composition of Spent Nuclear Fuel (Standard PWR 33GW/t, 10 yr. cooling)



Most of the hazard stems from Pu, MA and some LLFP when released into the environment, and their disposal requires isolation in stable deep geological formations.

A measure of the hazard is provided by the radiotoxicity arising from their radioactive nature.

1 tonne of SNF contains:

955.4 kg U
8,5 kg Pu

Minor Actinides (MAs)
0,5 kg ^{237}Np
0,6 kg Am
0,02 kg Cm

Long-Lived fission Products (LLFPs)
0,2 kg ^{129}I
0,8 kg ^{99}Tc
0,7 kg ^{93}Zr
0,3 kg ^{135}Cs

Short-Lived fission products (SLFPs)
1 kg ^{137}Cs
0,7 kg ^{90}Sr

Stable Isotopes
10,1 kg Lanthanides
21,8 kg other stable

Spent fuel and radiotoxicity (2)

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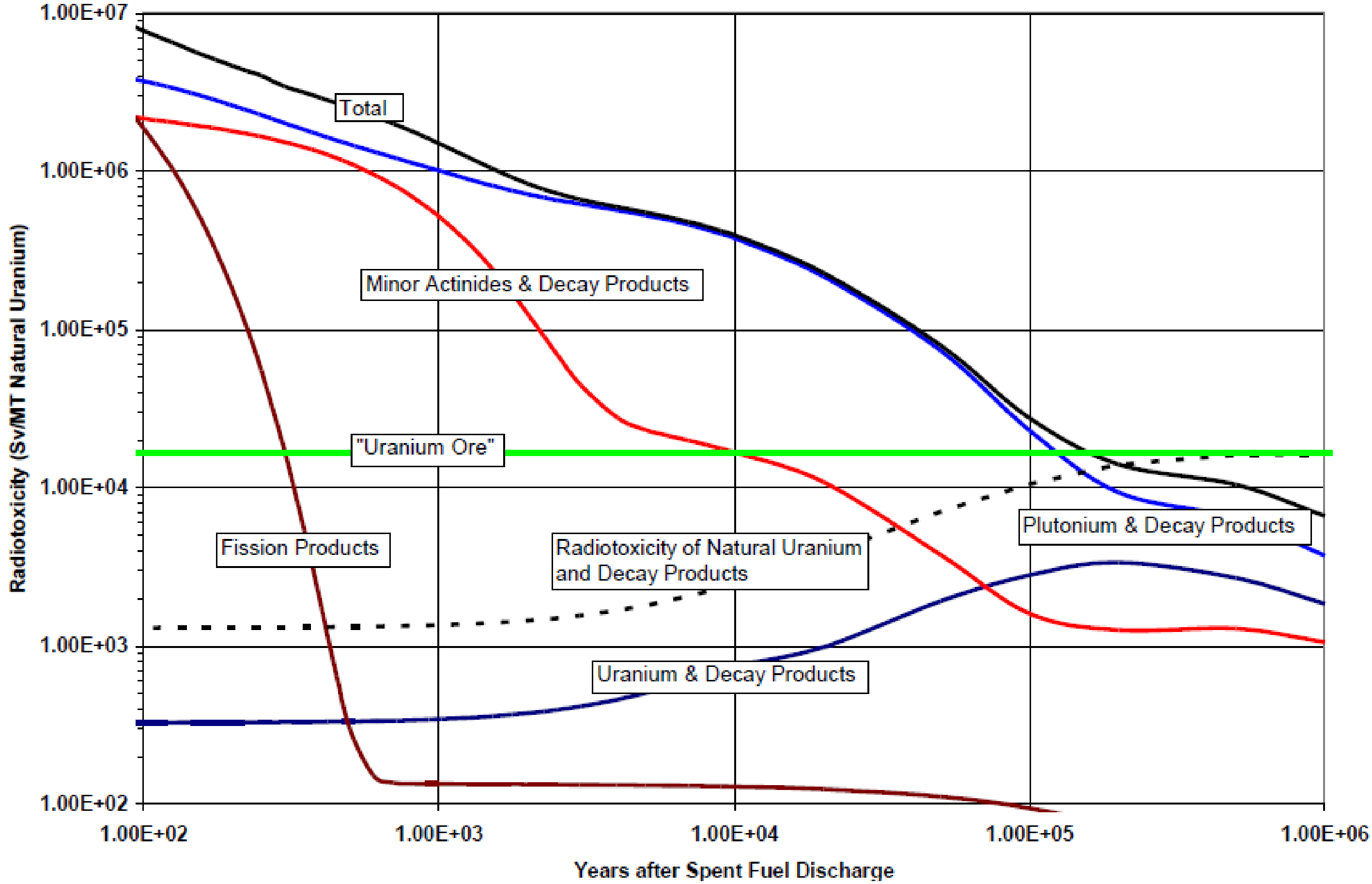
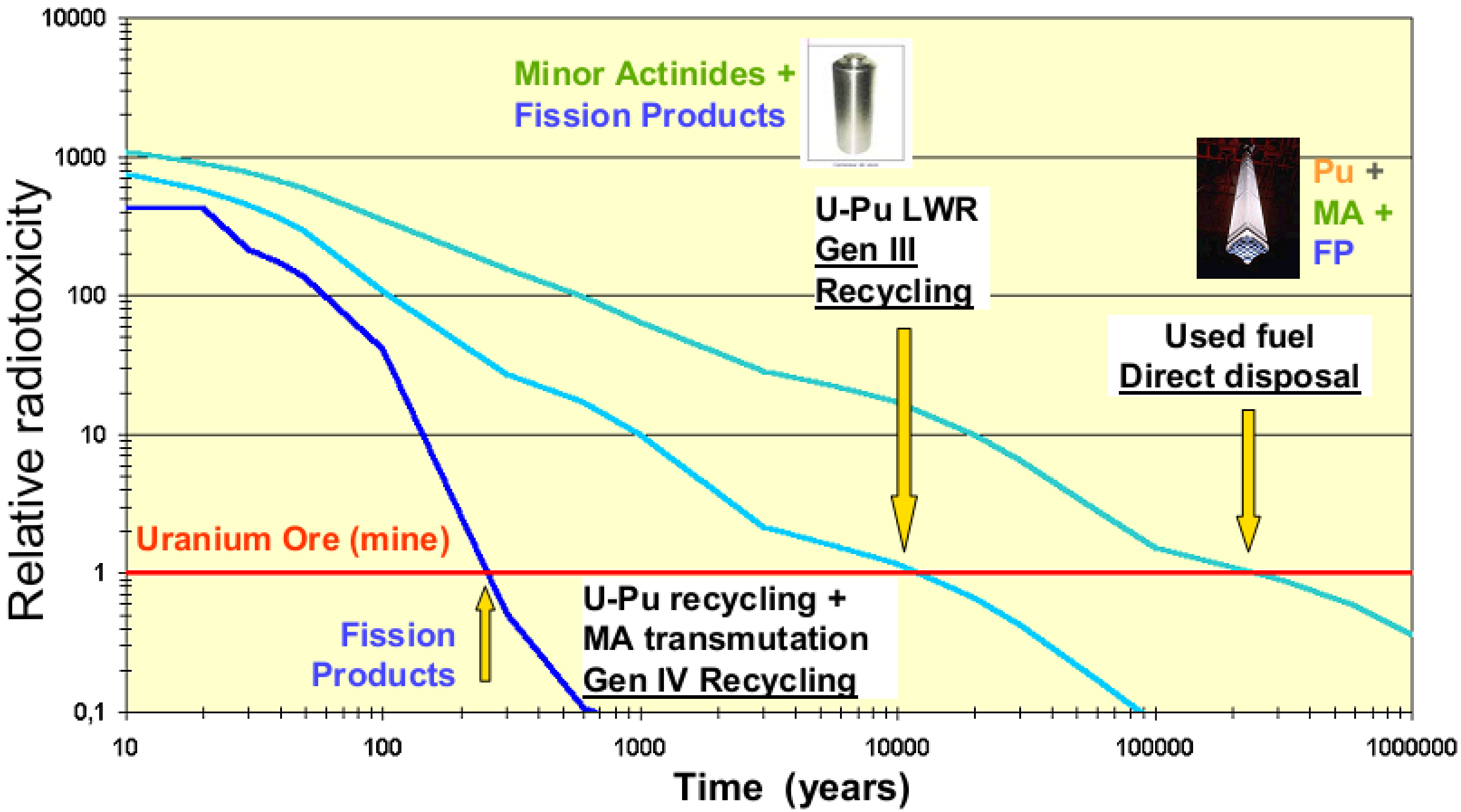
Evolution of the radiotoxic inventory, expressed in sievert per tonne of initial heavy metal (uranium) (Sv/ihmt) of UOX spent fuel unloaded at 60 GW d/t, versus time (years).



Repository Potential Radio toxicity



Technologic Patterns of SNF Management: Temporal Storage and Reprocessing

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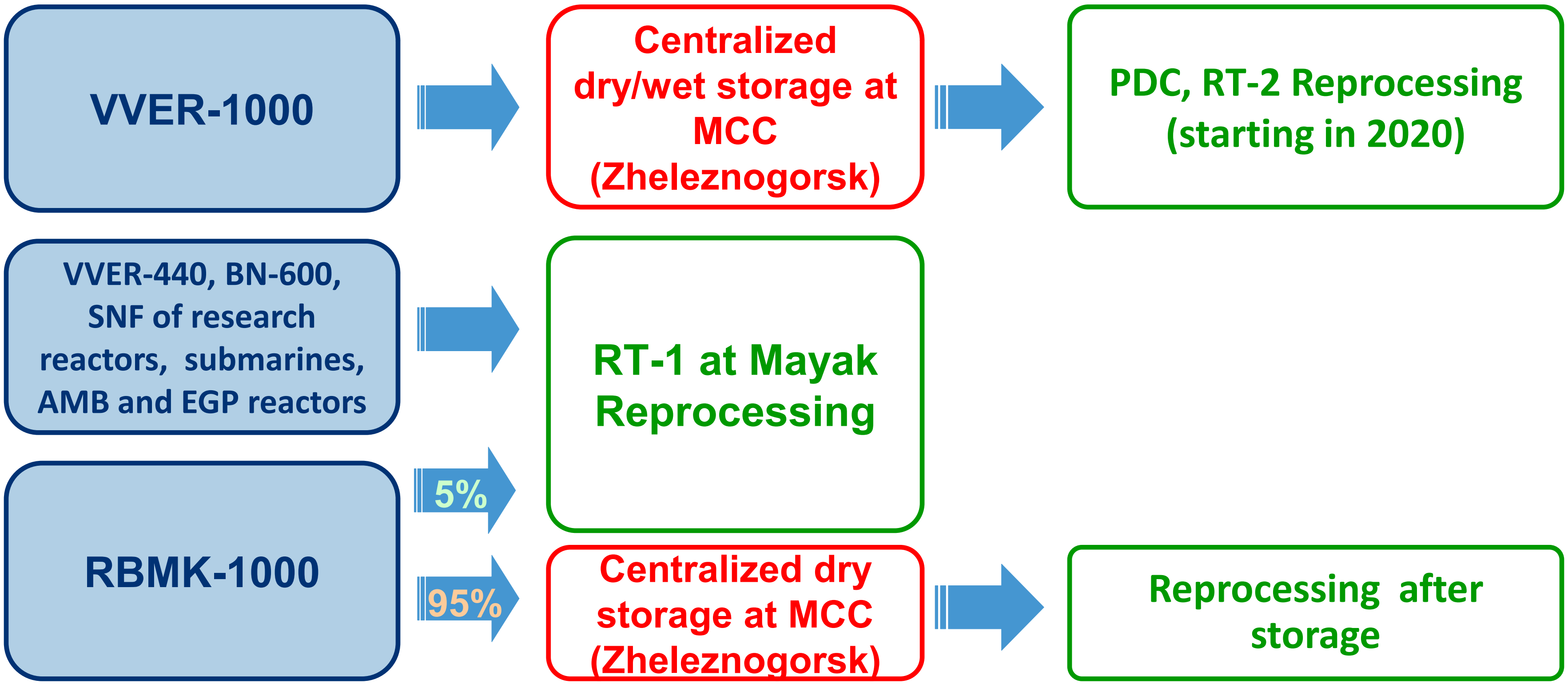

The basis of the Russian Federation policy in the area of SNF management is the principle of **SNF reprocessing** in order to ensure ecologically acceptable management of nuclear fission products and return of the regenerated nuclear materials into the fuel cycle. The strategic areas in SNF management are establishment of a reliable system SNF storage, development of SNF reprocessing technologies, balanced involvement of the SNF regeneration products into the nuclear fuel cycle, final isolation (disposal) of radioactive waste generated after the reprocessing.

RT-1 SNF Reprocessing Plant in Ozersk.
The first SNF Reprocessing Facility in Russia

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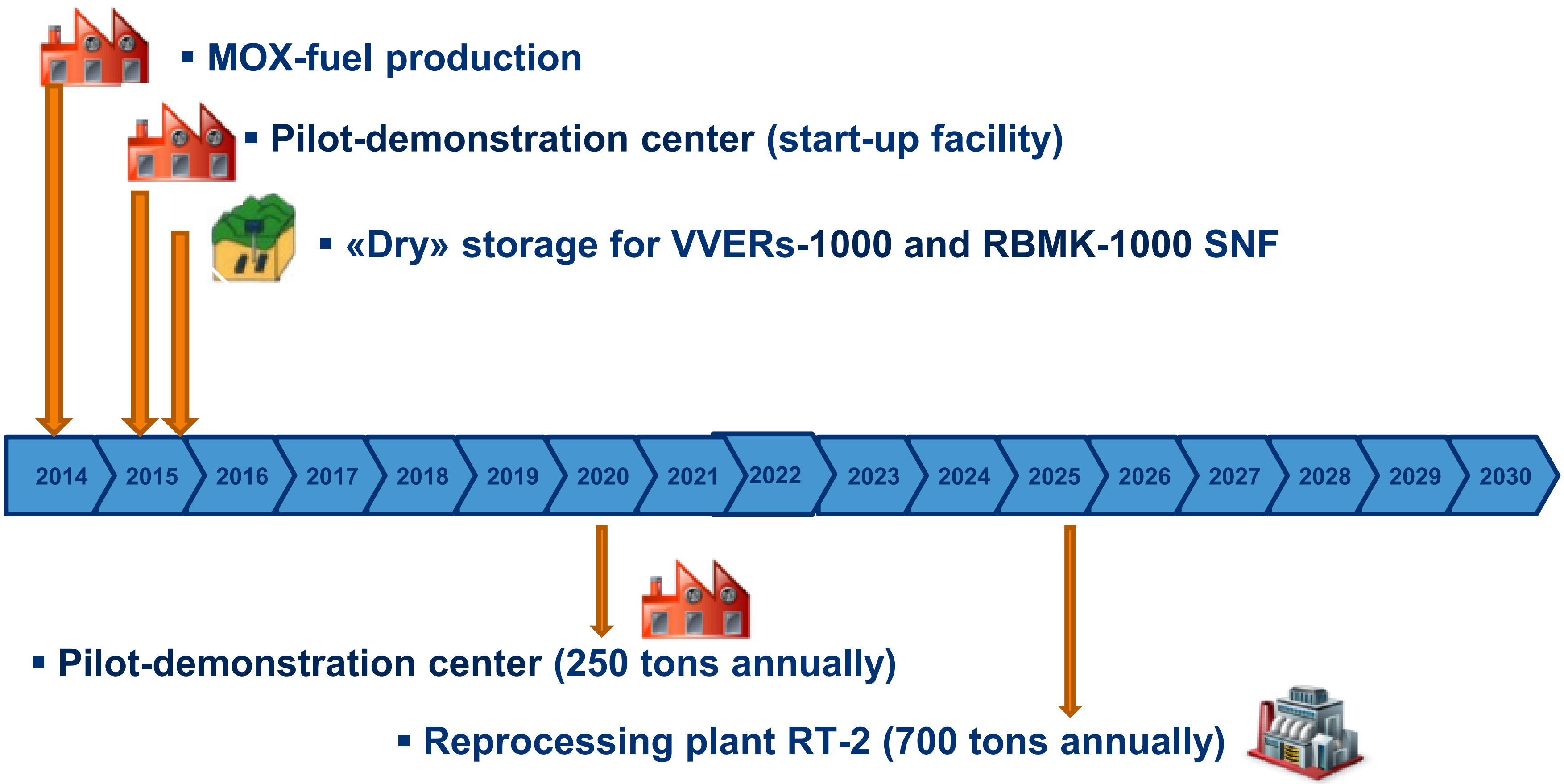
- The only SNF reprocessing plant in Russia
- Operation since 1977
- Over 5000 ton of SNF reprocessed
- Annual reprocessing of appr. 120-140 tons of SNF (from VVER-440, BN-600, research reactors, icebreakers and submarines)
- The list of the reprocessed SNF is diversifying (supplemented by the damaged spent fuel from RBMKs, plans for reprocessing of SNF from AMB, EGP and all the types of research reactors)
- The technology of reprocessing : Purex-process (extraction of regenerated Uranium, Plutonium and Neptunium as the reprocessing products), vitrified HLW
- Production of isotopes Cs-137, Am-241, Pu-238, Sr-90

Roadmap:
Development of SNF Management Infrastructure in Russia

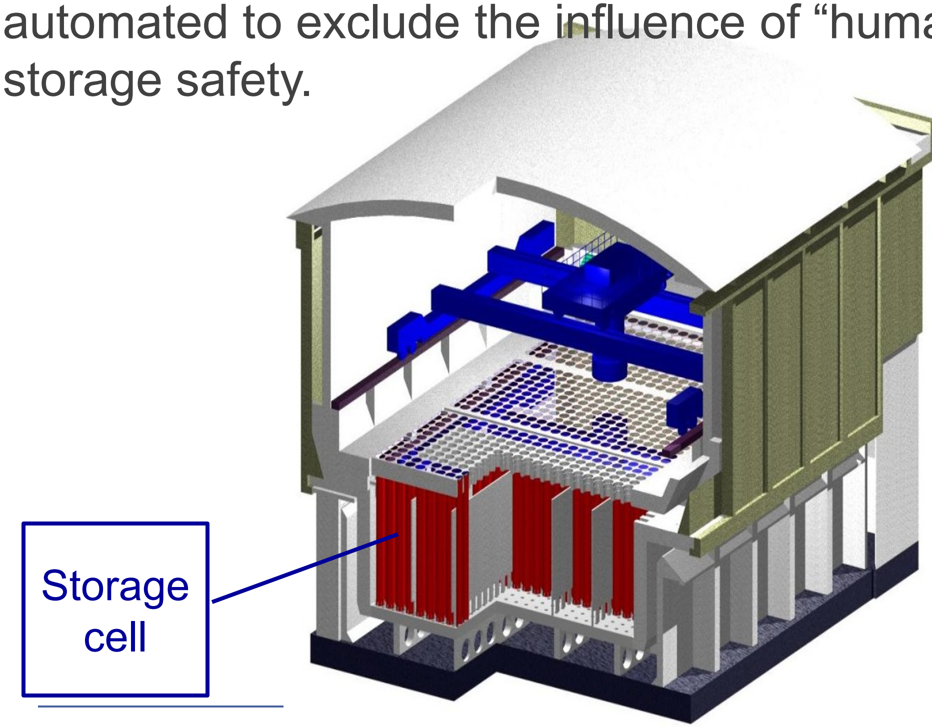


«Dry» Storage in MCC(Zheleznogorsk): Centralized SNF Storage

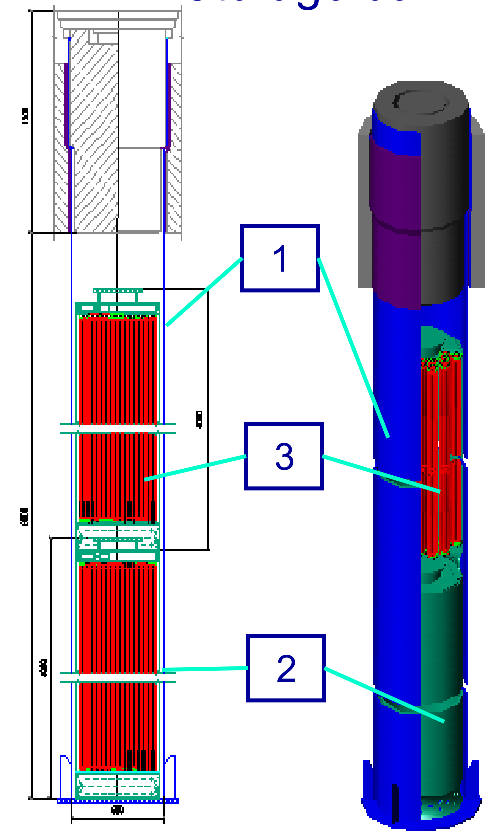
- The start-up facility has been already in operation
- Fully automated transportation equipment
- Gas charged casks (N_2+He_2), natural cooling
- Withstands the earthquake up to 9,6 MCP
- Withstands the aircraft impact with weight up to 5 tons

"Dry" centralized storage

The "dry" storing technology is based on the **passive principle of safety protection**
in case of a power supply loss all conditions of safe SNF storing will be retained thanks to the **natural air-cooling convection.**
All engineering operations while transferring SNF to the storage as well as the storing process itself are fully automated to exclude the influence of "human factor" on SNF storage safety.



Storage cell

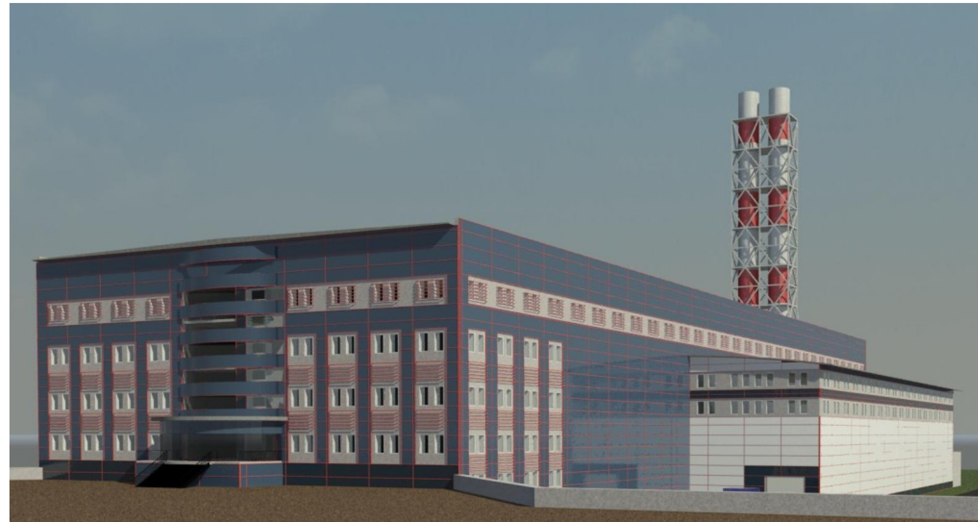


1 − storing seat;
2 − case with gas (N_2+He_2);
3 − fuel element of assembly

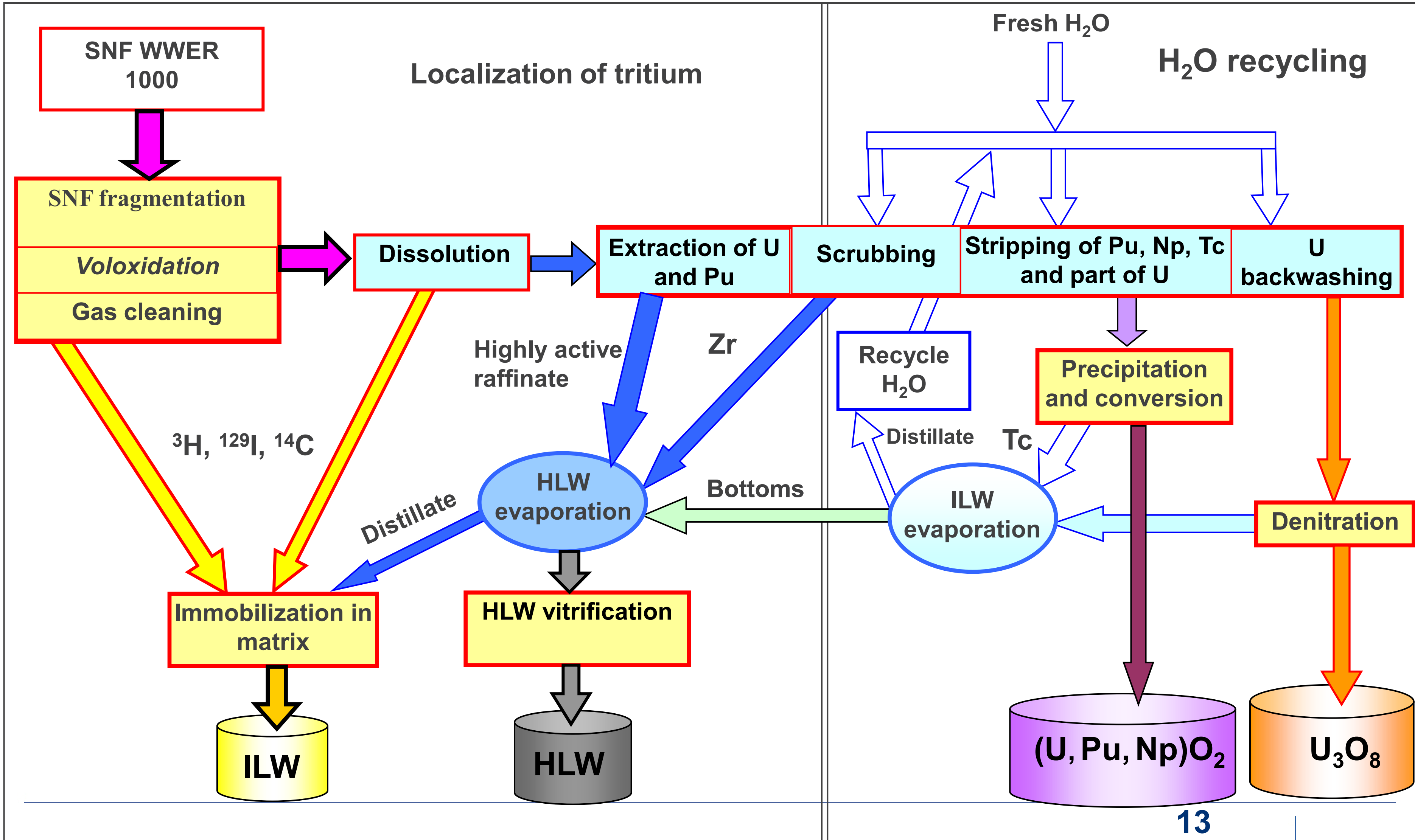
Pilot Demonstration Center for SNF reprocessing

2015 –The construction of the Pilot-demonstration center is currently in the progress, it is to be completed by 2015. The start-up facility incorporates research chambers (capacity -2-5 tons a year) , analytical center, and other elements of all necessary infrastructure. The purpose is to confirm the designed parameters of the new technological scheme.

2020 – The second start-up facility to be put into operation – full radio-chemical plant with capacities of reprocessing up to 250 tons/year. Innovative technologies of VVER-1000 SNF treatment to be developed; initial data for designing the full-scale radio-chemical plant and technology replication to be obtained.



«Basic» Pilot-demonstration Center Technology: Principal Technology Scheme



Radioactive waste generation after SNF reprocessing

Radioactive waste volumes	Existing technologies	Pilot-demonstration Center Technology
Vitrified HLW м^3/t SNF	~ 1	0,075
Solidified intermediate level waste , м^3/t SNF	~ 40	2,3
Low level liquid radwaste volume (Controlled release of effluents) , м3/t SNF	~ 100	No

Thank you for your attention

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