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State Atomic Energy Corporation ROSATOM
Federal State Unitary Enterprise MAYAK Production Association

Further Development of Radiochemical Reprocessing Activities at the Mayak PA

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Historical Background

1977 – start of SNF reprocessing

Over **5 650 tU SNF** has been transported and reprocessed in total

Current Activities at RT-1 Plant

SNF transport and reprocessing (recovery) – up to 160 t/a:

- power reactors (VVER-440 and BN-600)
- naval propulsion reactors
- research reactors
- industrial reactors at FSUE Mayak PA

Commercial product manufactured:

- UNH (uranyl nitrate hexahydrate) (enrichment 1 %)
- Uranium (IV, VI) oxide (enrichment > 5 %)
- Plutonium dioxide

Expansion of SNF range acceptable for reprocessing

2013 – 2014

RBMK-1000

U-Be

BN (MOX)

Routine process at the plant

Storage, mechanical fragmentation, dissolution

Extraction and commercial product manufacturing

Radwaste treatment

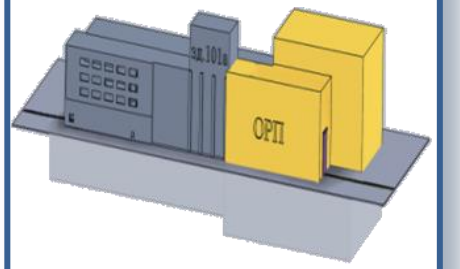
Expansion of SNF range acceptable for reprocessing

SNF from NPP reactors

VVER-1000,
in 2017

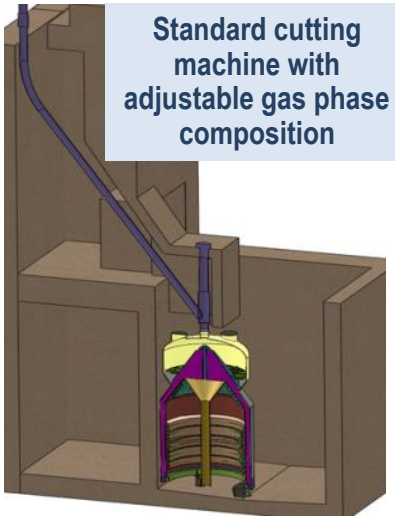
Heavy duty cutting machine AP-1000

AMB
in 2020;
EGP-6, KS-150
in 2025



Facility for NPP cutting and canister loading

U_{met}
in 2014;
Nitride fuel
in 2017



Standard cutting machine with adjustable gas phase composition

Expansion of SNF range acceptable for reprocessing

ГНЦ РФ - ФЭИ

НИИАР

НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ ЦЕНТР "КУРЧАТОВСКИЙ ИНСТИТУТ"

НИИП

Research reactor SNF,
non-standard fuel compositions

ИРМ

U-Zr and others,
PuO_2, Pu_{met},
PuC, PuN, Pu-Ga and others
in 2018

НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ ЯДЕРНЫЙ УНИВЕРСИТЕТ МИФИ

ОИЯИ

Electrochemical dissolvers

Future activities at RT-1 plant

SNF reprocessing
from domestic power reactors:

VVER-440, VVER-1000,
BN-600, BN-800

RBMK-1000,
AMB, EGP-6

Reprocessing of SNF
from domestic and foreign research and naval propulsion reactors, as well as of non-standard SNF

UC, UN, U-Zr, PuO2, Pu_{met}
U-Al, U-Be,
U_{met}

VVER-440, VVER-1000,
BN-350, KS-150


Bulgaria


Hungary


Slovakia


Armenia


Kazakhstan


Ukraine


Czech Republic

SNF reprocessing
from foreign power reactors

Reprocessing of any damaged domestic and foreign SNF packed in canisters

Plans for product output

Uranium product

- Uranyl nitrate hexahydrate (enrichment 1 to 3 %) – up to 400 t/a
  - Development of a process option is in progress providing U(IV, VI) oxide production with enrichment 1 to 3%
- U (IV, VI) oxide (enrichment > 5 %)

Plutonium dioxide

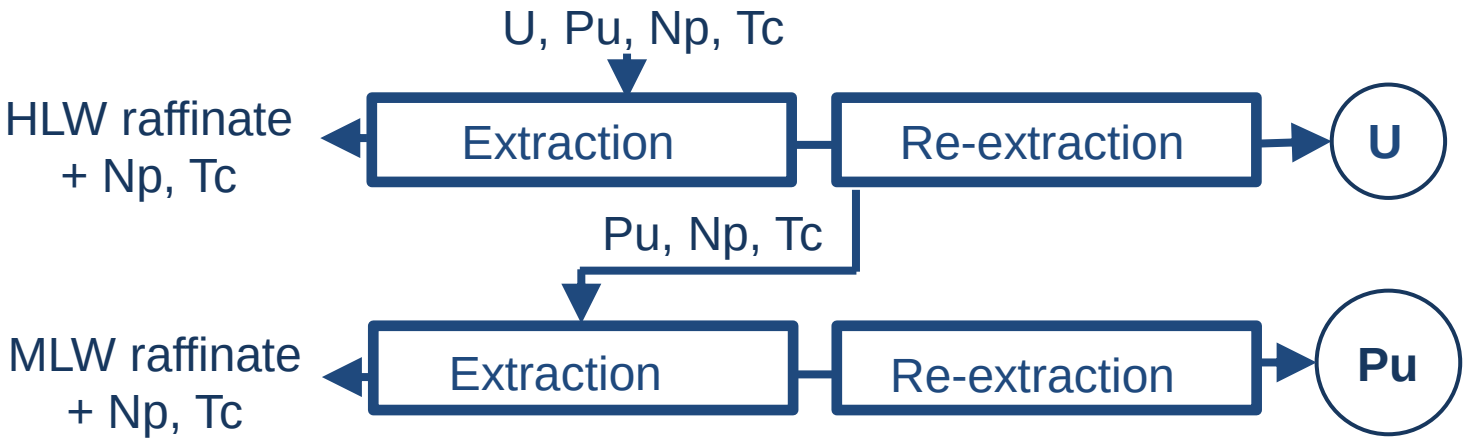
- For MOX fuel manufacturing for fast and thermal neutron reactors

Radioisotopes

- Cs-137, Kr-85, Am-241, Pu-238, Sr-90, Pm-147, Ce-144

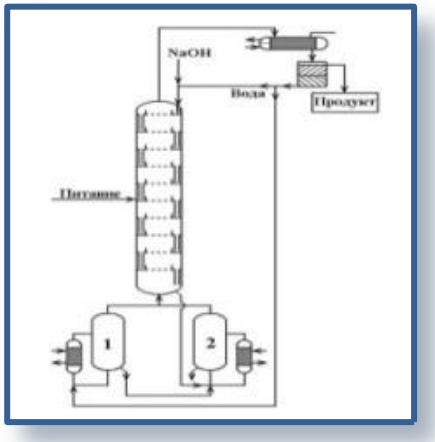
RT-1 process optimization

New design of SNF extraction flow chart



Membrane-type system for suspension clarification

Spent extractant recovery



Prospective radwaste treatment system

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Liquid radwaste

Decontaminated water

Concentrates

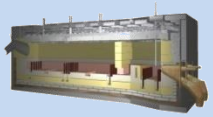
Cement solidification facility
in 2015

Pilot decontamination installation
in 2014

Decontamination facility
in 2020

MLW

New vitrification facility
in 2021



Electrical vitrification melter system ЭП-500/5
in 2015

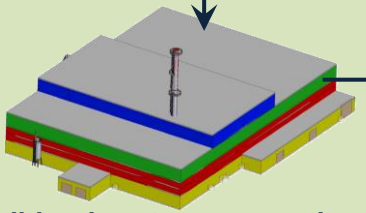
LLW

HLW

SNF reprocessing at RT-1 plant

Solid radwaste

Solid radwaste



Solid radwaste reprocessing facility
in 2025

HO PAO

National operator for radwaste management

Conclusions

1. Implementation of above mentioned measures will result in universalization of RT-1 plant by 2018 as a radiochemical facility providing reprocessing of a wide range of spent nuclear fuels including damaged and out-of-specification fuels

2. RT-1 plant **is now ready for throughput enhancement in terms of VVER-440 SNF reprocessing** from Russian and foreign NPPs

3. **In 2017** RT-1 plant **will be available for VVER-1000 SNF reprocessing**

4. Establishment of new production facilities for radwaste treatment will provide the capability for RT-1 plant to considerably enhance **environment safety**.