OPERATING EXPERIENCE AND LESSONS LEARNED ON MANAGING NON-STANDARD LEGACY SPENT FUEL FROM POWER AND RESEARCH REACTORS IN RUSSIA

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Rosatom

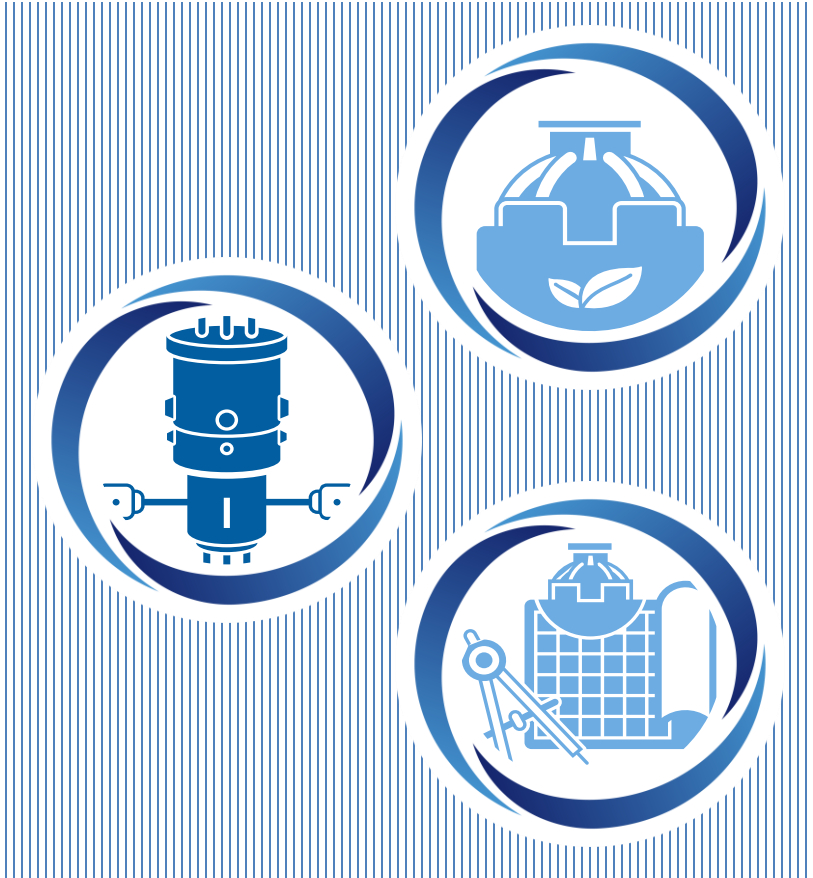
Unusual characteristics

Dimensions

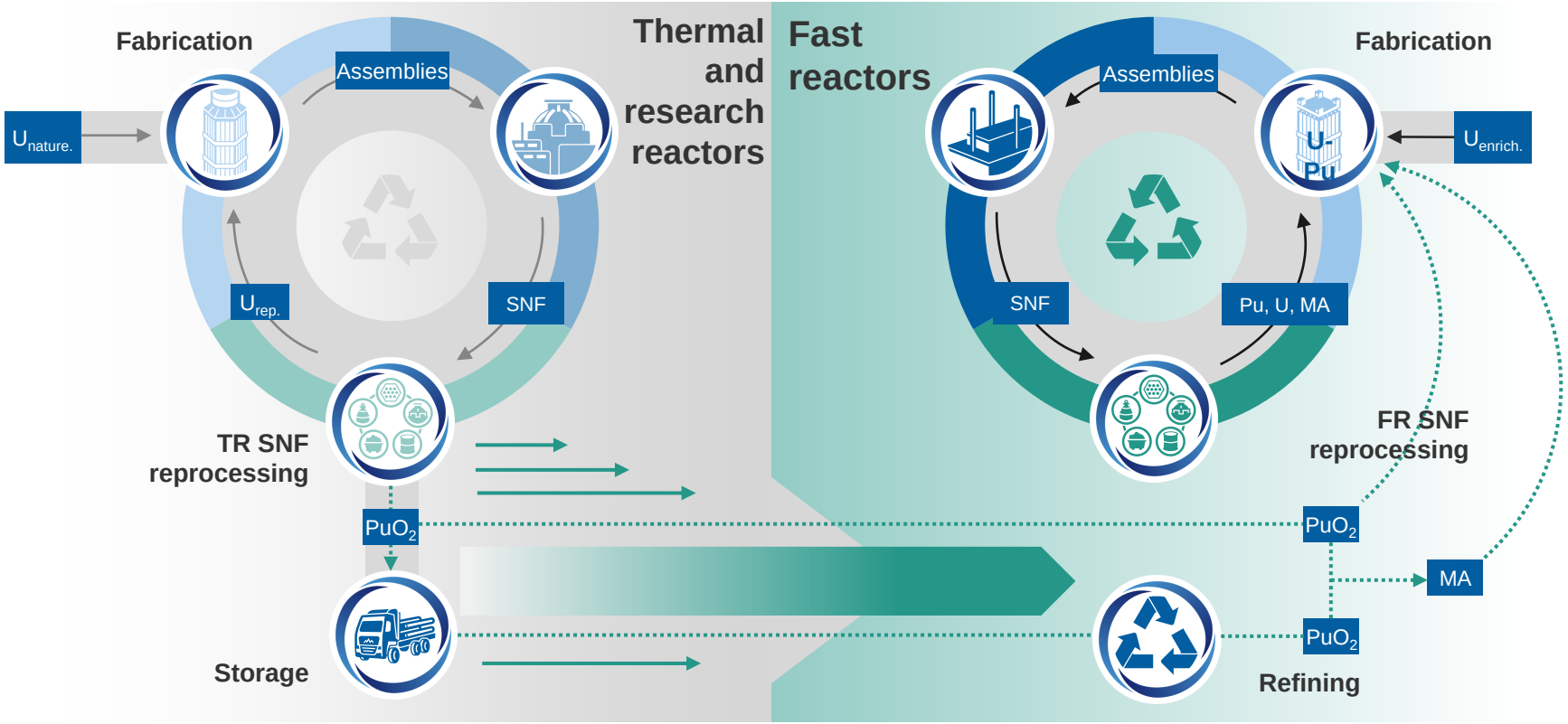
Fuel composition

Fuel assembly construction

Defects of FA and fuel composition



Closed nuclear fuel cycle



Preparation stages

The evaluation of the SFAs intended for management (transportation, storage, reprocessing).

Inspection of baskets, casks and storage cells.

For new routes or new types of SNF development of transport and technological scheme.

Development of radiochemical technology for reprocessing.

Equipment development and manufacture.

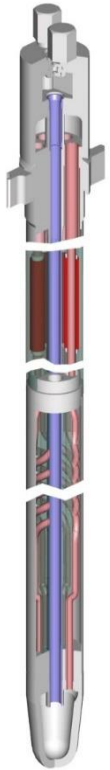
Registration of permits for the transportation, storage, reprocessing etc.

Pilot, experimental operations of transportation and reprocessing.

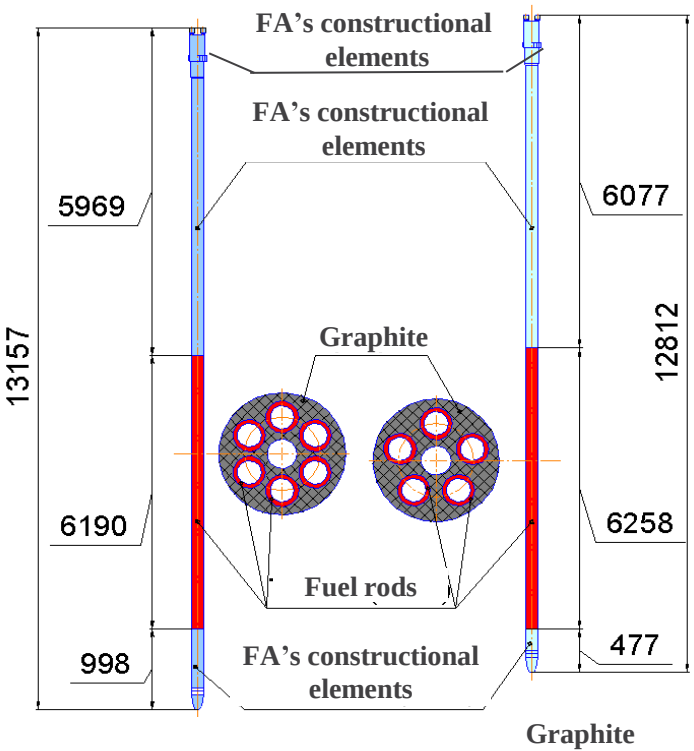
SNF TRANSPORTATION BY

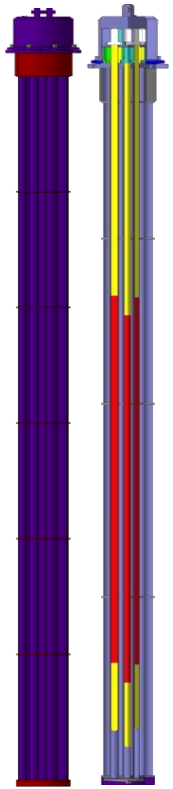
ALL MEANS OF TRANSPORT

SNF AMB Characteristics



Fuel assembly





Containers

Container without lid

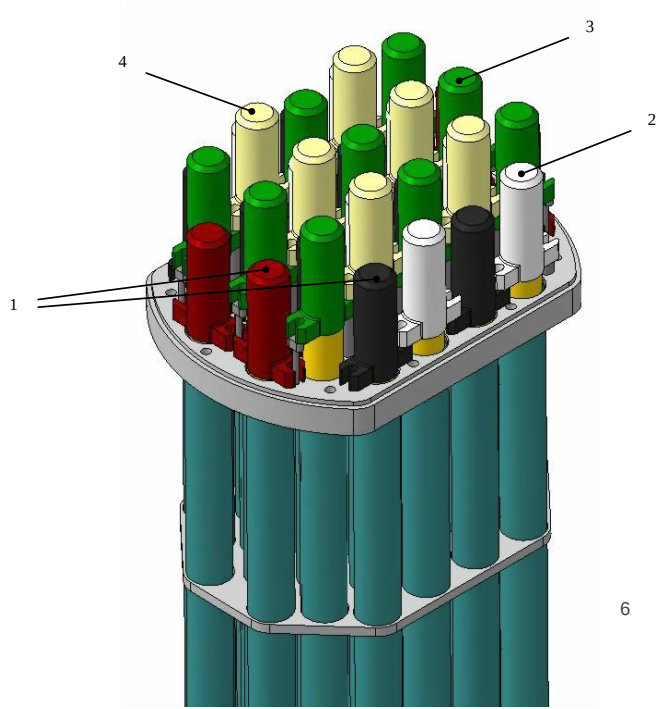
Fuel types

Main part

- Uranium dioxide;
- Uranium dioxide in magnesium matrix;
- Uranium dioxide in copper-magnesium matrix;
- Uranium-molybdenum alloy in magnesium matrix;
- Uranium-molybdenum alloy in calcium matrix;
- Uranium carbide in calcium matrix.

Enrichment: from 1.5 to 21 %

Average burnout 15 GW*day/tU



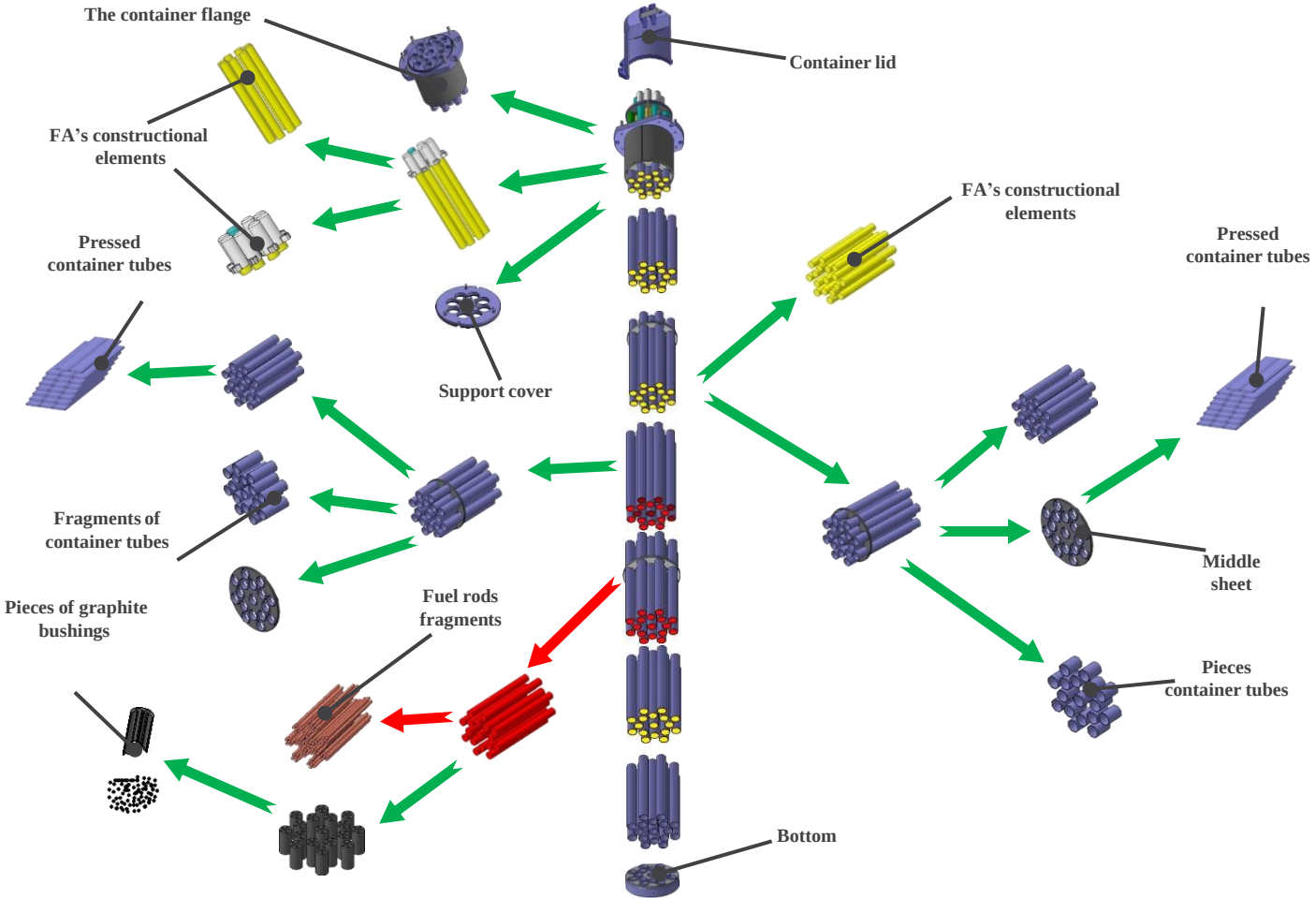
Transportation of AMB SNF

Cask testing

Cask in carriage

Train

Container and FA fragmentation



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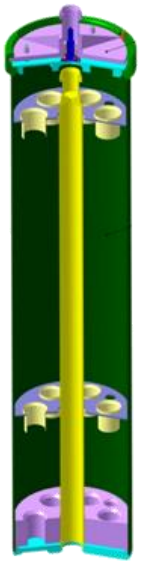
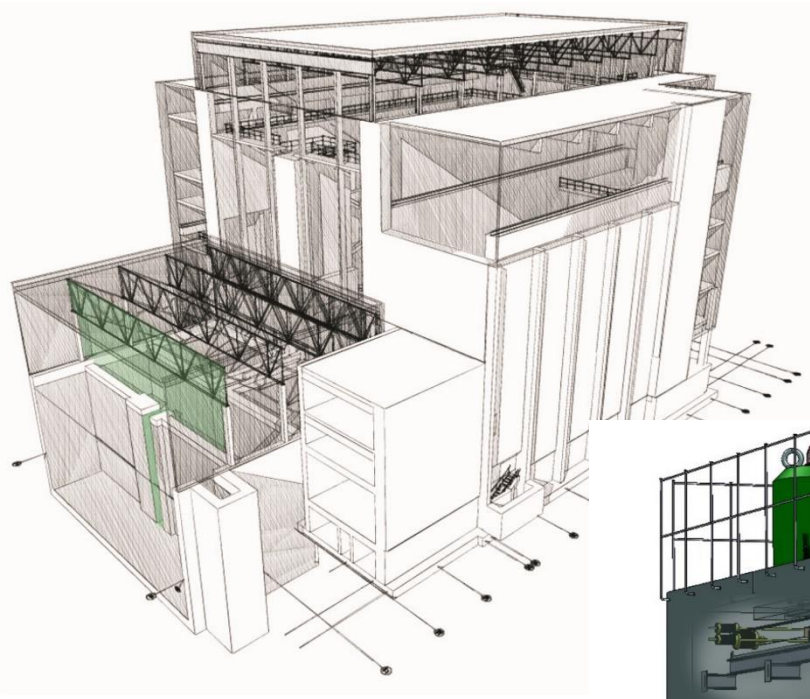
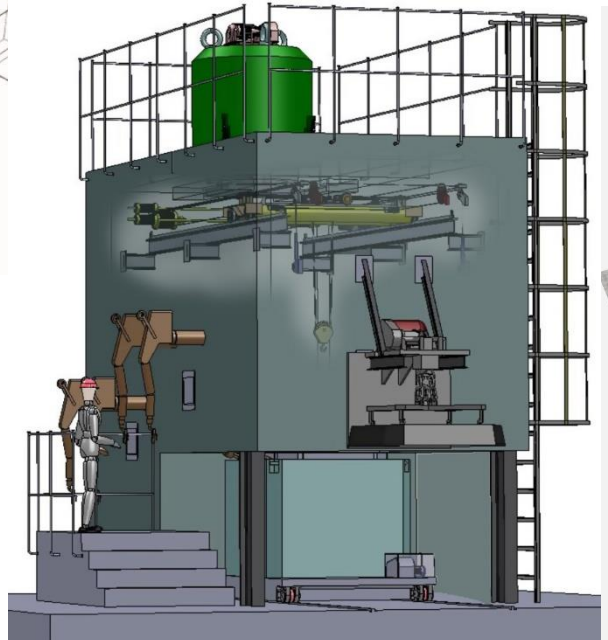
Canister



Basket

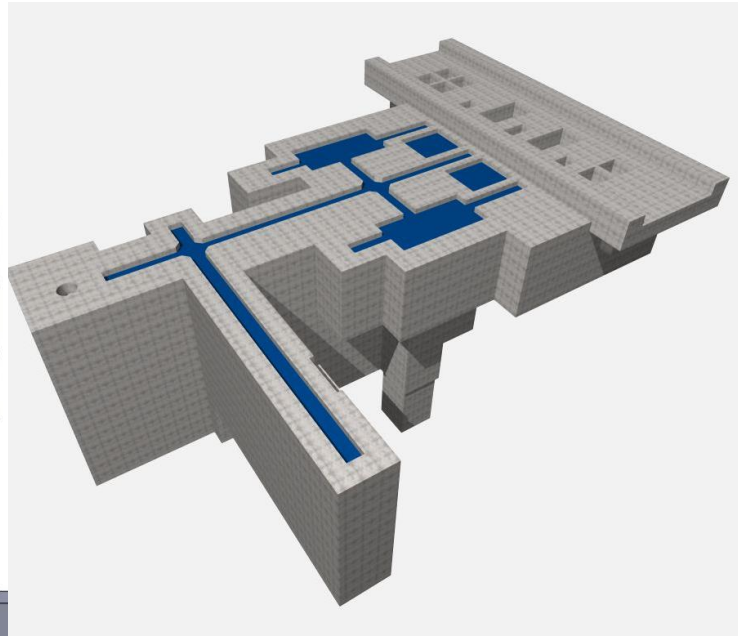
AMB FAs preparation workshop



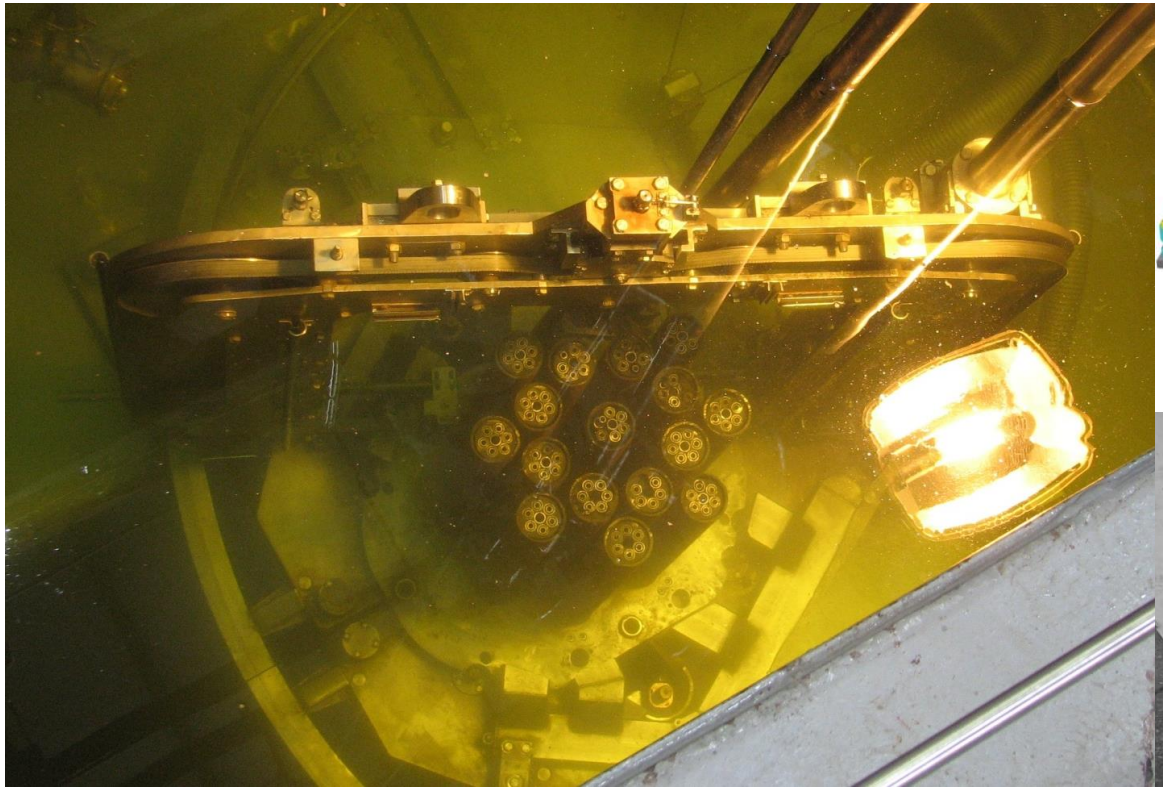


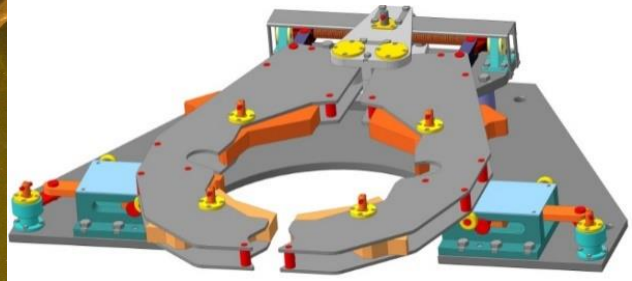
Hot cell for defining
RAW characteristics

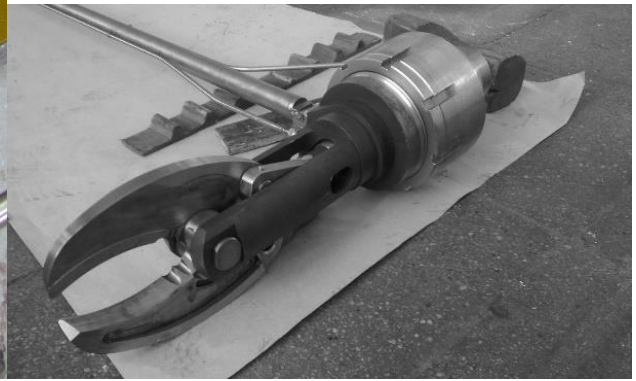
Transport system



Testing underwater cutting of FAs

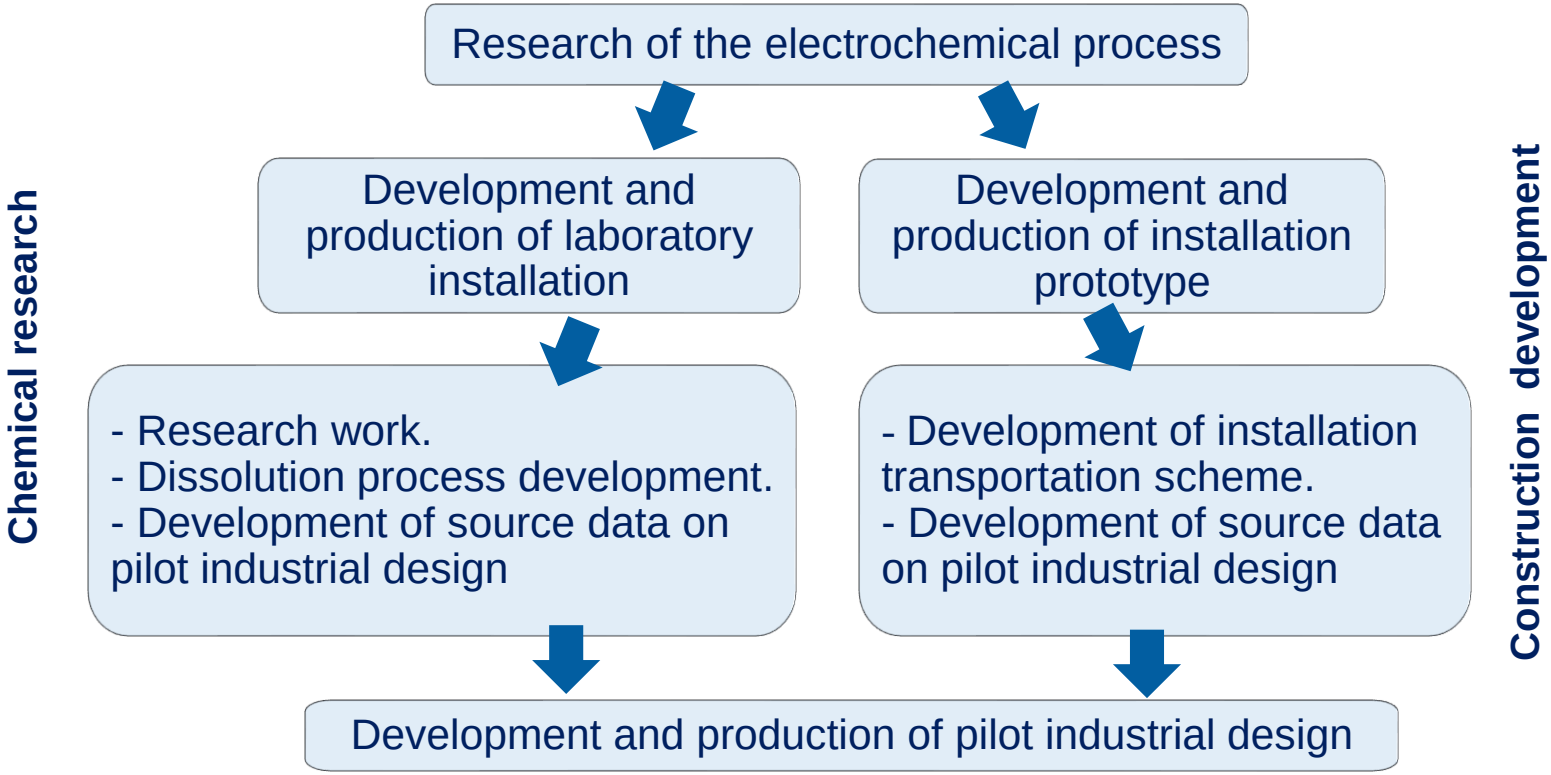




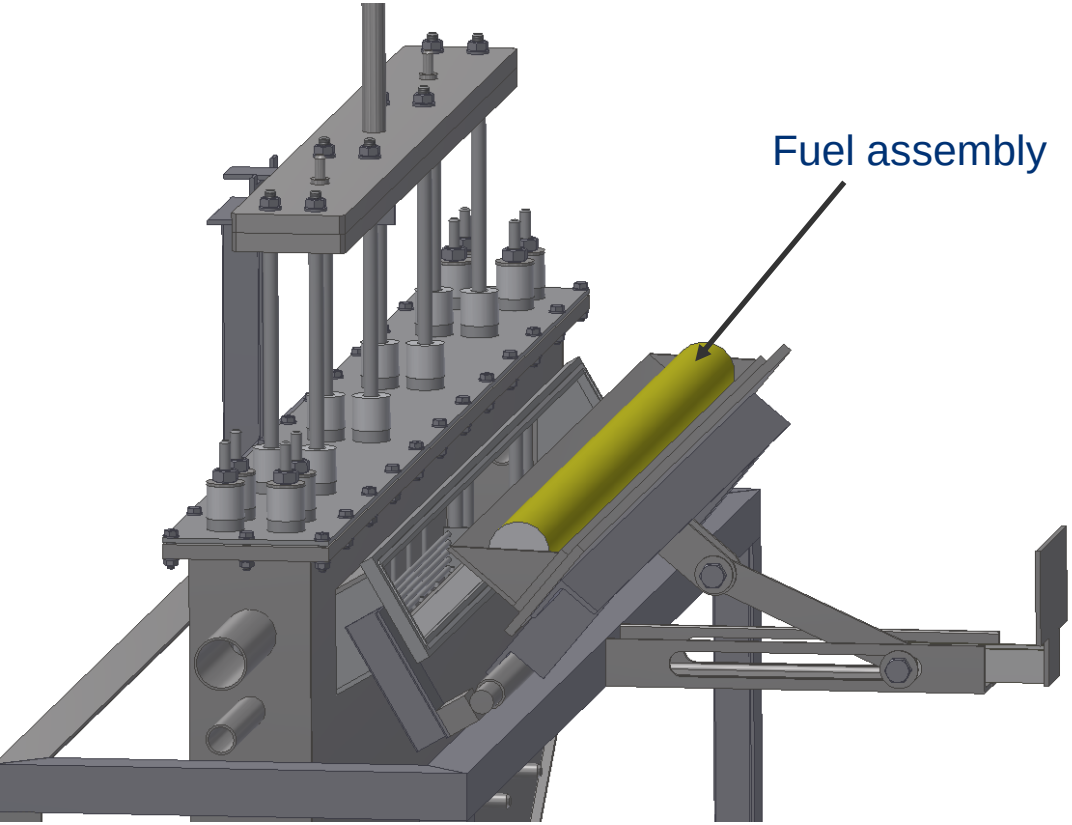


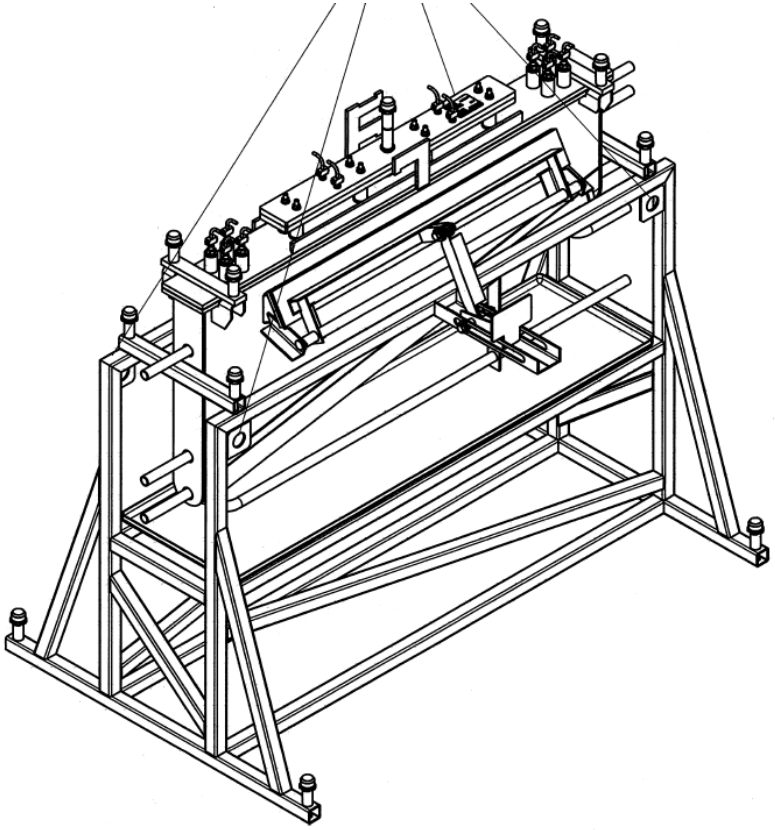
Nuclear icebreakers uranium-zirconium SNF

Scheme of development an electrochemical dissolver unit



Dissolver unit prototype





Specifications of liquid SNF

SNF type – an aqueous solution of uranyl sulfate (UO_2SO_4)

Density – about 1,2 – 1,3 g/cm^3

Volume – 20-24 l

Burnout – 0,02 %

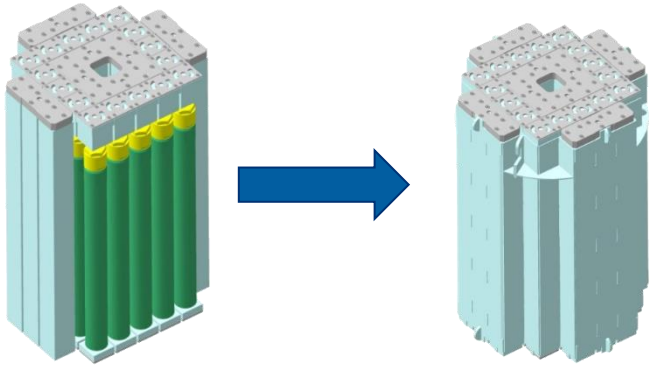
Uranium enrichment – 19,75 %

Mass U-235 – 1,8 kg

Transportation of liquid SNF

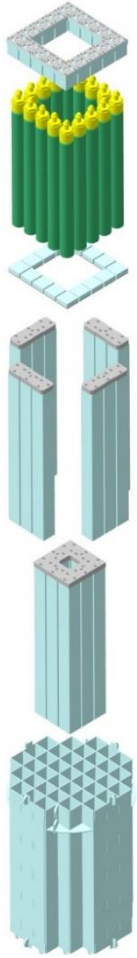
Internal basket of the ŠKODA VPVR/M container TUK-145/C (type C package)

Limiter system with 16 limiters

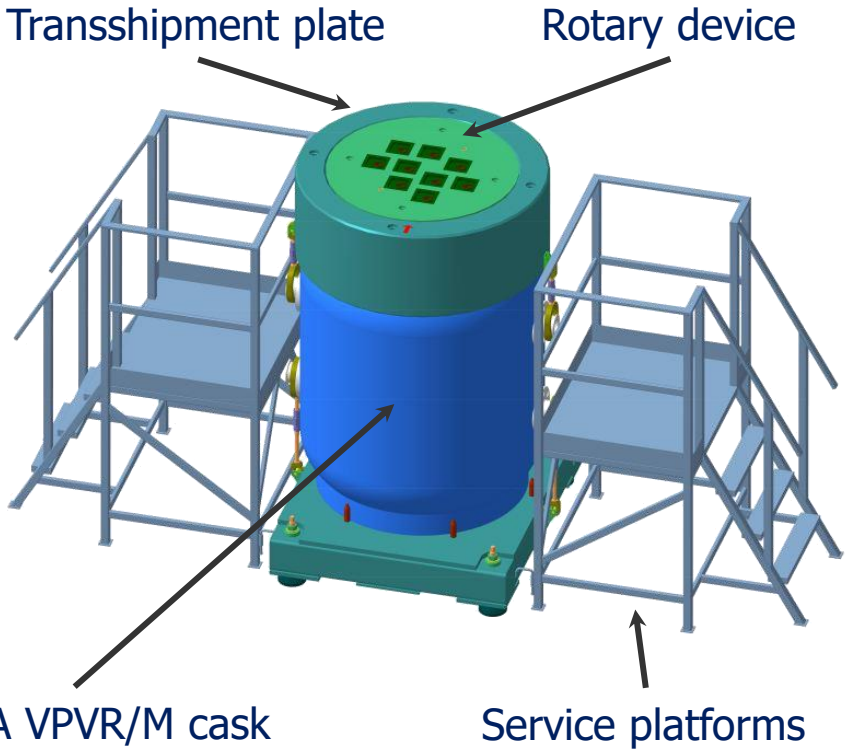


Limiter system consists of 4 types of limiters.

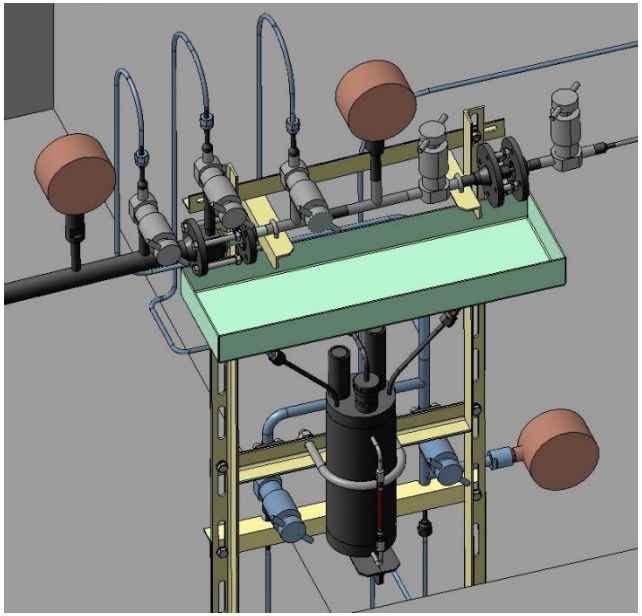
Main construction material for limiter system is low-pressure polyethylene



Loading and unloading equipment for liquid SNF



Liquid SNF transfer unit



Conclusion

- Russia has accumulated extensive experience in handling non-standard legacy SNF at reactor sites, in transportation, reprocessing, and RAW management.
- 99% of such nuclear fuel accumulated in Russia has already been recycled, is being recycled, or there are technologies for handling it, including reprocessing.
- It is planned that all types of atypical SNF will be recycled in the medium term.

Thank you
for your attention

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