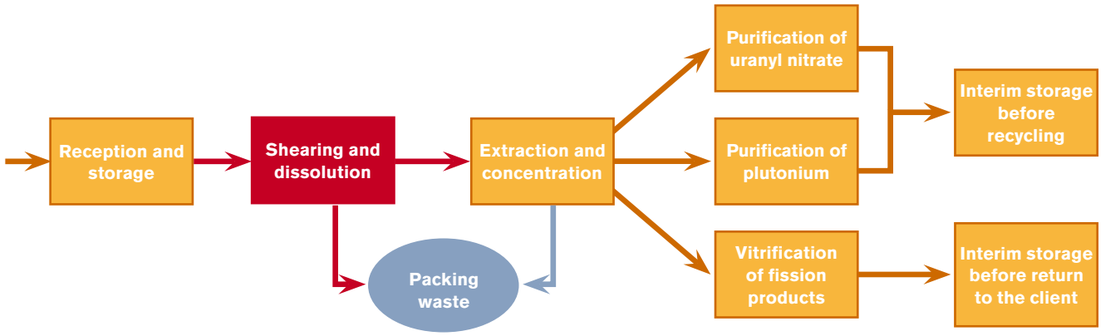
Reprocessing : the whole story



Plutonium Redissolution Unit (URP)

By dint of radioactive decay, plutonium oxide powder self-generates americium-241, an element not used for producing energy, that increases with time. After a few years in storage, it becomes necessary to purify the plutonium oxide before it can be used in MOX fuel. This first stage in the purification process is dissolution, and it is carried out in the URP, one of the units in R1 facility.

1/ Unpacking plutonium oxide
The successive packagings are removed at the entrance to the facility. The powder is then sent to the hopper that feeds the electrolyser.

2/ Dissolution
The powder is dissolved in a nitric solution in an electrolyser in the presence of silver ions.

3/ Matter analysis
After dissolution, analyses are carried out in an analysis tank to determine the quantity of matter to be introduced during the fuel reprocessing procedure. The solution is diluted before being transferred to a different tank in R1 facility (blended with processing solutions), or directly to R4 facility via a tank in R2 facility.

4/ Recycling plutonium
The solution is then processed in R2 and R4 facilities.

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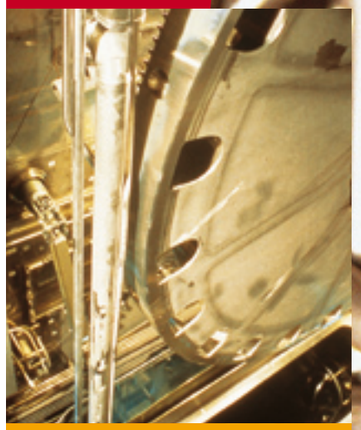

REPROCESSING NUCLEAR FUEL
R1 AND T1 FACILITIES

Shearing and dissolution

Bertaud & Associés - Nantes B 316 844 323 00022 - Photos : AREVA NC - M. Ascani, P. Lesage, S. Jezequel

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The tasks of shearing combustible elements, dissolution, and analysing nuclear matter are carried out by remote control in this automated facility. The processing of structural waste (hulls and end-pieces) commences at this early stage. T1 facility is equipped with two production lines. R1 facility has only one.

Control room.

Tilting crane: feeder bridge in shearing facility.

Three parallel production lines

1/ Feeding and checking

Once the cooling down period in the pool is over, the fuel is transferred to R1 and T1 facilities. There, its identity and combustion rate are established before shearing commences.

2/ Shearing

Fuel is cut into lengths of approximately 35 mm. These “hulls” contain the nuclear matter. Gravity makes them fall into a 12-scoop dissolution wheel. Top and bottom end-pieces are handled separately: they are evacuated to the endpiece rinsers.

3/ Dissolution

The nuclear matter contained in the hulls of the fuel pins is extracted by dissolution in the boiling, concentrated nitric acid. The solution overflows towards the clarification unit. The zircaloy-based hulls are evacuated towards the hull rinsers.

4/ Processing gasses

Gaseous emissions produced during dissolution are processed, washed, and filtered.

5-6/ Clarification and analysis unit

Clarification is the process whereby “fines” from shearing (shreds of zircaloy) and insoluble fission products are removed from the solution thanks to centrifugation. Insoluble fission products are stored in a workshop awaiting vitrification. Clarified solutions are sent to the analysis unit then on to the R2 and T2 extraction/concentration facilities, where nuclear matter is separated.

7-8/ Packing and storage

After the Residual Fissile Matter (MFR) has been rinsed and checked, the hulls and end-pieces are packed in shuttle drums. These drums are sent to the compacting facility (ACC).

9/ RTR fuels

RTR (Research Testing Reactor) are research reactors, spread throughout more than 35 countries, intended for studying fuel materials as well as for studying physics such as the radiation/material interaction, safety, etc.

The fuels used in these reactors are distinctive in that they have a high uranium 235 enrichment factor, they are much smaller than the fuel elements used in nuclear power stations, and they are clad in an aluminium alloy.

T1 facility operate the specific treatment process linked to the characteristics of these RTR fuels since 2005.