

Joint Research Centre (JRC)

Nuclear Decommissioning Unit
Ispra - Italy



Packaging and Transboundary Transport of PuO₂ and MOX Material

S. Lutique, F. D'Alberti, C. Osimani

R. Donati, R. Vespa

*Joint Research Centre
Ispra (VA), Italy*

*MIT Nucleare
Carugate (MI), Italy*

<http://www.jrc.ec.europa.eu/>

JRC - NDU mission:

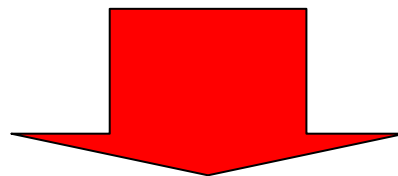
"JRC- NDU is responsible for managing the D&WM Programme of the Ispra Site. The programme is aimed at the progressive elimination of the site's historical and future liabilities (nuclear facilities and materials no longer used for JRC research purposes), with the return of the site to a status of no radioactive hazard".

JRC Ispra site hosts 6 nuclear facilities to be decommissioned:

- Radiochemical Lab, RCHL, decommissioning almost finished
- Liquid Treatment Facility, STRRL, decommissioning just started
- Hot Cell Lab, LCSR, and
- 2 Research Reactors, FARO and ISPRA1, in pre-decommissioning phase
- Research Reactor Complex, INE, hosting active research laboratories, starting pre-decommissioning phase



One of the most important pre-decommissioning activity is the removal of Nuclear Material: PL-19




Aim of the project: returning to a non-Italian owner the Nuclear Material lent to the JRC during 80s for NDA research and training activities carried out in PERLA Lab in INE complex

Materials involved in the project:

- Pins and Rods of MOX
- Powder of PuO₂ and MOX



Type of material:

- 16 short rods (length up to 0.5 m)
- 17 long pins (length up to 2.5 m)
- Few kg of U and less than 1 kg of Pu
- Maximum dose rate 4.8 mSv/h (γ +n)
- Various Pu isotopic compositions  up to ~ 7% of Am



Interesting operational challenges in the material preparation and packaging mainly concerning radiological protection due to the high dose-rate



Type of material:

- **59** Model containers
- **4** types of containers
- From **10 g to 2.5 kg Pu** per container
- Few tens of kg of Pu total
- Maximum contact dose rate **6 mSv/h** ($\gamma + n$)
- Various Pu isotopic compositions with **Am** content up to **~ 7%**
- External temperature in ventilated vault $\sim 40^{\circ}\text{C}$, but able to increase rapidly without a heat removing system



- J.R.C. Internal Authorisation for plant modification, validated by I.S.P.R.A.
- A.S.N. Authorisation for receiving plant modification
- Export License by Italian Ministry of Economical Development
- Transport Licenses for carriers in both countries
- Nuclear Safety Transport Permit by I.S.P.R.A.
- Technical safety Certificate by Italian Ministry Transport
- Transport Cask Certificate by I.S.P.R.A. and A.S.N.
- Emergency response for road accidents
- Nuclear Liability Policy

Transport organisation

- Due to type of materials (fissile): use of 2 armoured trucks
- Italian law requirement: foreigner carrier could operate under the responsibility of Italian carrier in Italie
- Bilateral agreement between both Safety Authorities on the information and procedures
 - Vehicle inspection, custom procedure, turnover of drivers and stops

Emergency response

- Approved at National and Local level (all provinces crossed)
- Identified risk scenario, human and technological resources and countermeasures

PVC bags degradation

- Radiolysis under irradiation and heat induced
- Production of **H** for 20 years

Pu ageing

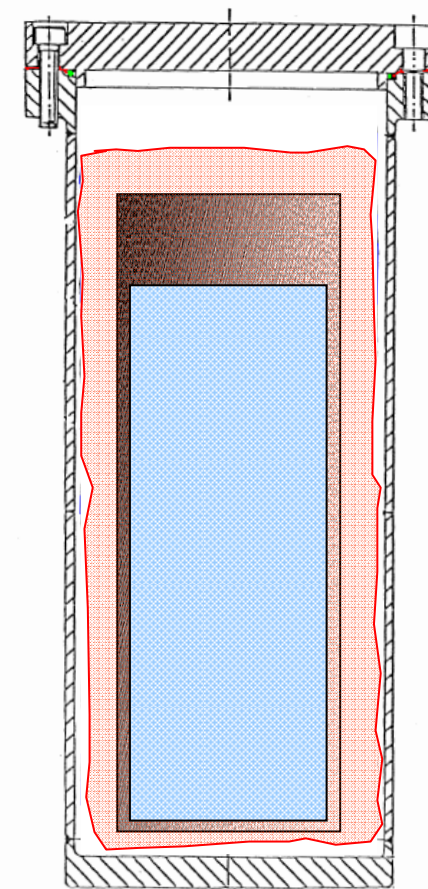
- Production of **Am** depending of the original isotopic composition

Transport requirement: **Venting**

- Changing atmosphere inside outer container with inert gas (He)
- Short time between venting and reopening to limit quantity of H produced during transport

Facility status: **Refurbishment & Modifications**

- INE facility is used only for NDA research or training
- No handling of inner container done for 20 years
- GB foreseen for handling of fresh Pu



Original status

2 GB without connection: one for U and one for Pu handling

Requirements

- 1 GB shielded for Pu venting under He
- 1 GB for eventual decontamination under air
- Connection between both GB

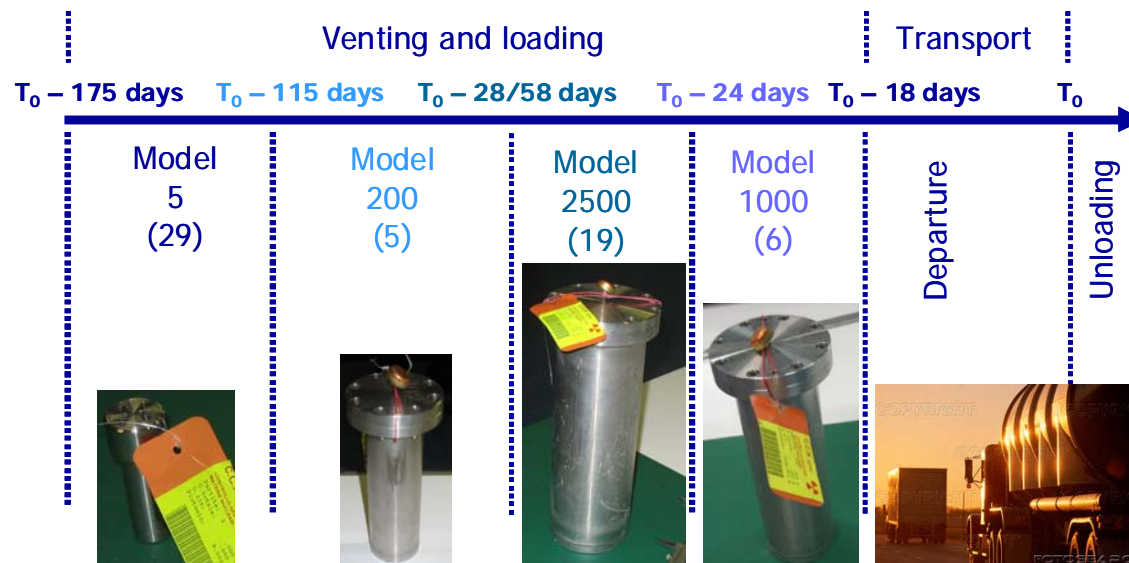
Criteria

- Handling equipment for each Model type
- He feeding system
- Size adapted to the room access (door width and height)
- Connexion to the existing feeding system (electrical, ventilation, alarm...)





Tight schedule, no delay allowed!



Contingency actions deduced from risk analysis

- spare parts for models: containers, o-rings, screws
- spare parts for equipment: filters, gloves
- new gas-based leak tightness test apparatus
- back-up staff: operator, supervisor, radiological staff
- on-duty services: maintenance, medical, decontamination team

Pu transfer in to shielded GB



Opening of Model container



Model purging with He gun



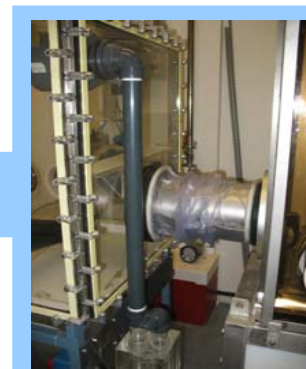
Operation duration

- 59 models vented in 28 working days
- Handling activity duration ~4h cad
- Venting operation duration ~2h cad
- Leak test ~ 1h cad

Temporary transfer in to the store ready for shipping cask

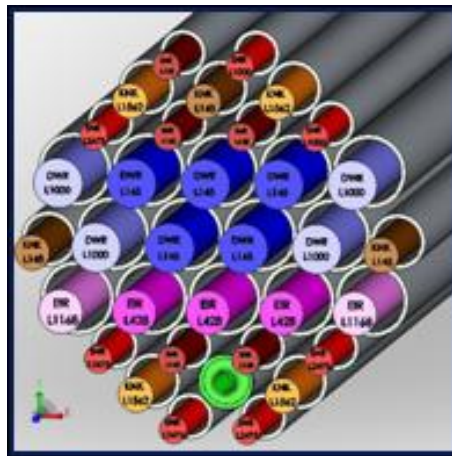


Leak test



Transfer into the second GB for decontamination

Loading into two types of transport container:



FS65 for pins, holder welded



- TN-BGC1 casks filled up with He for bigger Model boxes
- Departure during night
- Convoy of 28 vehicles including police and fire brigade

Project successfully concluded over 2 and half years

- 2 year for designing
- 6 months operation (from GB installation to departure of convoy)

Work organisation

- ~ 50 persons involved
- Strict radiological protocol
- Two 8-hours shifts per day from 7 am to 11 pm
- Heavy security measures

Achievements

- Reduction of JRC future liabilities concerning NM
- Step forward to INE decommissioning
- Downgrade of security level
- Reduction of nuclear safeguards