



# Towards a permanent disposal of the nTOF radioactive waste

---

Luisa Ulrici (SC/RP)

ATC-ABOC

CERN, January 24, 2007

## Outline:

- Legal basis for waste disposal
- nTOF radioactive waste
- Technical requirements for disposal
- Schedule
- Costs

# WASTE DISPOSAL

## Legal Basis

nTOF waste have to be disposed of according to the Swiss radiation protection legislation

- **Radiation Protection Ordinance 22 June 1994 (814.501, modified on 15 November 2000)**
- Elimination of radioactive waste towards a final repository is a legal requirement
- Determination of:
  - Doserate
  - Surface contamination
  - Specific activity + nuclide inventory
  - LE values

# WASTE DISPOSAL Actors

**OFSP/BAG:** Federal Office of Public Health

- Authority of reference in matter of radiation protection and waste disposal
- Sets the legal framework for the disposal of radioactive waste

**NAGRA:** National cooperative for the disposal of radioactive waste.

- Plans the final repositories for radioactive waste in Switzerland
- Sets the conditioning requirements for the acceptance in the final repository (to be built)

**PSI:** Paul Scherrer Institute

- Responsible for collection, conditioning and storage of the radioactive waste from industry research and medicine
- Sets conditioning requirements for acceptance of waste in the swiss temporary storage facility

# nTOF RADIOACTIVE WASTE

- TARGETS
  - Present (activation + contamination)
  - Future (Al cladding to avoid contamination of cooling water)
  
- Other
  - water (if not suitable for free release in environment)
  - heavy water (limited quantities accepted by PSI)
  - Solid metallic waste (maintenance, upgrade, dismantling etc.)





# nTOF OLD TARGET

---

- **OFSP** agreed to the final disposal of the old target in Switzerland
- **NAGRA** calculated the total content in alpha-emitters. From these results the target could, in principle, be accepted in the temporary storage (PSI) and in the final repository.
- **PSI** asked for a visit of n-TOF in order to get familiar with the installation and its radioactive waste. During the visit, an analysis of the radiological risks of the old target will be performed in order to define the conditioning for the delivery to the temporary storage.
- The delivery is subject to some technical requirements
  - Maximum dose rate at the surface of the waste container 2 mSv/h
  - No volatile contamination (container needed)
  - Dimensions adapted to fit in the final container for waste conditioning



# TRANSPORT REQUIREMENTS

---

- Type A – exclusive use
- UN 2915 if the dose rate is:
  - $<2$  mSv/h at contact of the waste container and external surface of the transport type A container
  - $<100$   $\mu$ Sv/h at 1m distance of the waste container
  - $<100$   $\mu$ Sv/h at 2m distance of the transport container
- If the above conditions are not satisfied : special arrangement UN 2919 (not recommended)
- ➡ Shielding is needed to bring the dose rate down to 2mSv/h at the external surface of the waste container
- Contamination: waste container needed (to be decided with PSI)

# REQUIREMENTS FOR THE TARGET CONTAINER

- Tight container against dissemination of contamination
- Weight of the content 5 Tons
- It is suggested to include the shielding in the container, if dimensions and weight are compatible
- The waste container will probably be disposed together with the waste (lost container)
- Agreement by the SC-RP-Shipping Service and by the FI- Logistic Service is necessary

# SCHEDULE

- The elimination of the old nTOF target can be performed after
    - 1) The waste container has been found (by the n-TOF collaboration with assistance of SC/RP), discussed and accepted by both PSI and CERN shipping service
    - 2) The contamination of the target is assessed by measurements at the moment of its removal from the irradiation condition
    - 3) PSI visit + discussion on the conditioning
- ⇒ About 6 months





# DESIGN OF THE NEXT TARGET

---

- Recommendations for the design of the next target:
  - Cladding => minimize contamination of the water in the cooling system
  - If aluminum is chosen for the cladding, the design shall foresee the possibility to remotely dismantle the cladding
  - Knowledge of the chemical composition of all materials used in the target (for the calculation of the nuclide inventory).



# CONCLUSION

---

- An elimination pathway for the targets of nTOF exists and the disposal can be carried out according to the Host-States regulation
- The disposal of the old target soon after its removal from the irradiation position has the double advantage of
  - Comply with the legislation requirements
  - Eliminate the need of the construction of a second storage place for the future target
- The resources needed to perform this disposal will be confirmed after the conditioning of the target will be discussed with PSI