

Radiological characterization of a cyclotron in view of its dismantling and final disposal

Nathan Van Raemdonck

nathan.vanraemdonck@student.uhasselt.be ; nathan.van.raemdonck@gmail.com

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Introduction

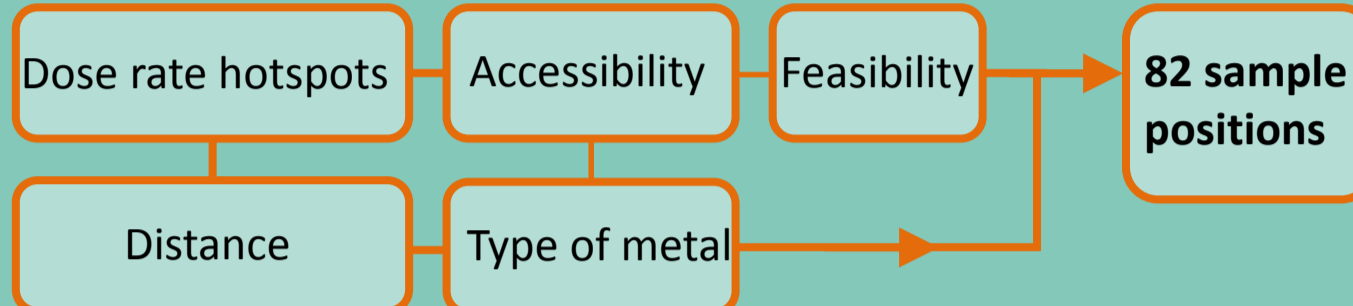
- ❑ CGR-MeV cyclotron at Fleurus, Belgium
- ❑ Used for medical isotope production: ^{131}I and ^{201}Tl
- ❑ Acceleration of protons up to 67 MeV
- ❑ Since 1993 out of commission
- ❑ Now, after 20 years of inactivity, it is intended for dismantling.
- ❑ Internals and surrounding materials of the accelerator are activated.
- ❑ Preparation for dismantling:
 - Need of radiological characterization of metallic components in cyclotron vault.
 - Determination of final disposal options based on Belgian release levels and acceptance criteria of specialized nuclear melting facilities.

Objectives

- ❑ Radiological characterization of metallic parts in the cyclotron vault.
 - Quantitative
 - Qualitative
- ❑ Elaboration of options for final disposal of activated metallic components.

Methods

Drilling campaign



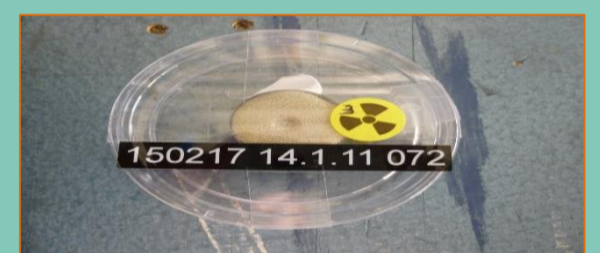
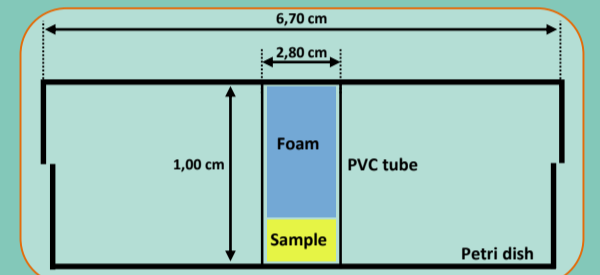
- ❑ Drilled with common electric drill
- ❑ 5 sample locations drilled deeper
 - obtain variation of specific activity with depth.
- ❑ 1 gram of metallic chips

Measurement

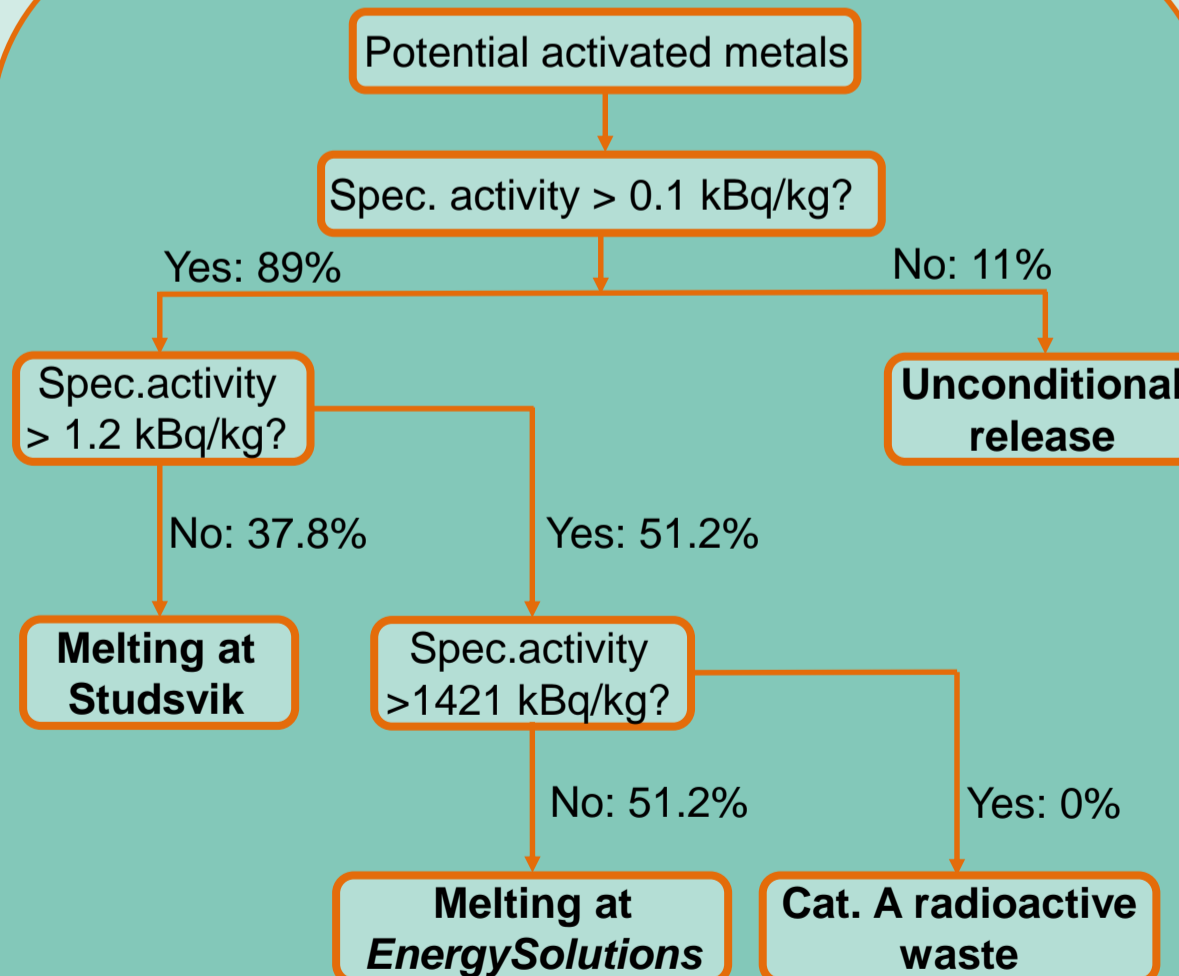
- ❑ Extended range coaxial high purity germanium detector
- ❑ Time of measurement: 1 – 48 hours
- ❑ Apex gamma™ for spectrum analysis and gamma spectroscopy

Calibration and geometry

- ❑ Same methodology and geometry for all 82 samples.
- ❑ Petri dish with little PVC tube to hold metallic sample.
- ❑ Piece of foam to permanently fix the position of the sample.
- ❑ Multi-gamma calibration source in petri dish geometry for efficiency calibration
- ❑ ^{152}Eu source for energy calibration



Result final disposal



Result characterization

- ❑ ^{60}Co : only radionuclide identified in metallic samples
- ❑ Specific activity varies between not-detectable and 328 kBq/kg

Conclusions

- ❑ ^{60}Co is the only radionuclide identified in metallic components.
- ❑ Max specific activity of 328 kBq/kg
- ❑ Activated metals:
 - 11% for unconditional release
 - 89% for specialized melting
- ❑ No cat. A radioactive waste from metallic components.

Promotoren / Copromotoren: dr. ir. Herwig Janssens (Hasselt University), Philippe Damhaut (ONDRAF/NIRAS)