

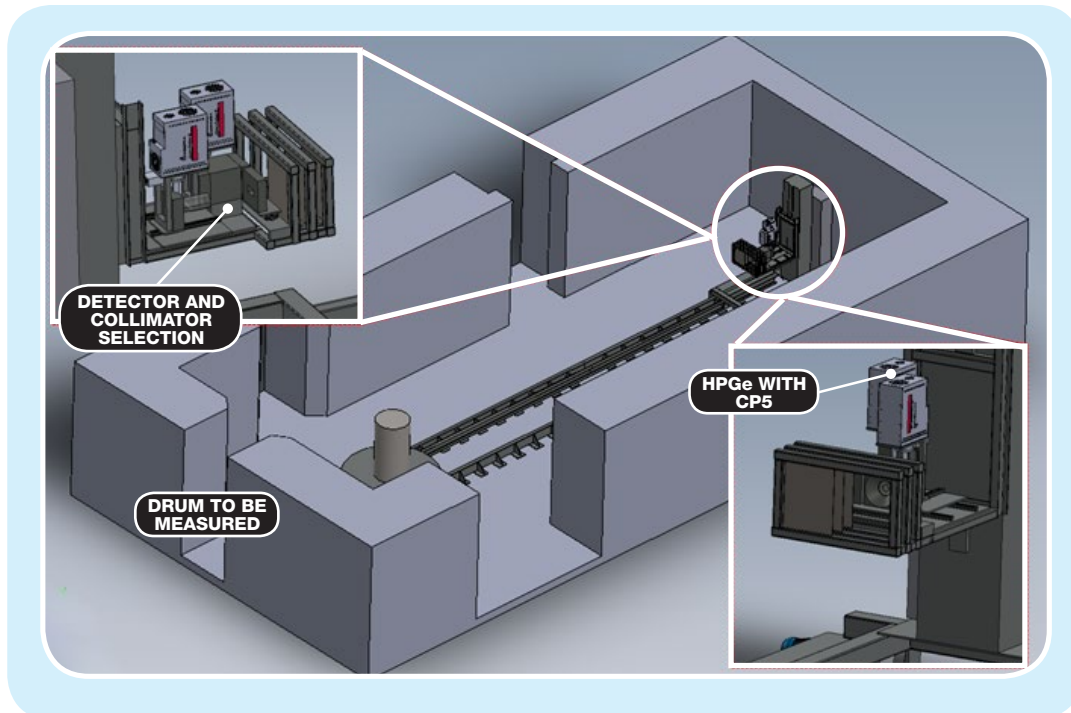
Feasibility Study: Gamma Spectrometry of High Activity Waste drums

Scope:

- The future “CIGEO” facility, managed by the French Nuclear Waste Agency, is designed for long-life medium and high activity waste final disposal.
- Once built, nuclear waste from all of French industry will be shipped to this facility.
- Some drums will go through a full characterization process, for various quality and safety checks.
- Around 150 types of drums containing about 200 different radionuclides are expected.

Key Drivers:

- Need to precisely assess the footprint required for spectrometry measurements.
 - Large concrete walls are mandatory for radiological protection, making civil work a significant cost for the future facility.
 - Space optimization and forecast is key in this project.
- Measurement range: from Intermediate Level Waste (ILW) to High Level Waste (HLW), up to 10^{15} Bq at ^{137}Cs , without detector saturation.
 - Ensure that the waste activity level remains in the range allowed by the license of the storage facility.
 - Declare the activity to the National Agency of Radioactive Waste for costs and scenario forecasts.
- Final study report to be delivered within two months.



Visit our Measurement and Expertise (M&E) page.



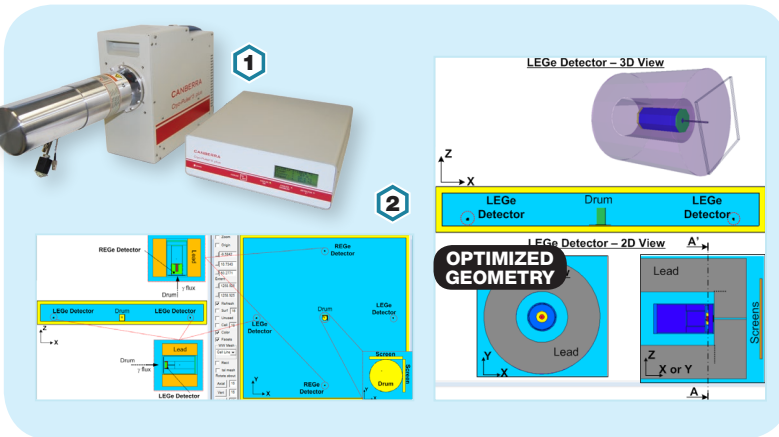
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Feasibility Study: Gamma Spectrometry of High Activity Waste drums

Case Study

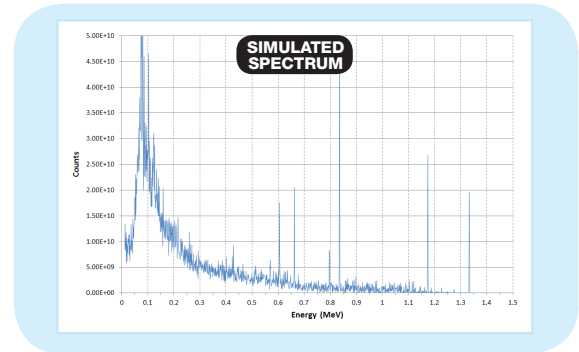
Instruments & Techniques Used:

- 1 HPGe Cryo-Pulse® 5 Plus detectors
- 2 MCNP® calculation code



Total Counts/s at 10m		Exposure time	
3.09E+04		4.44E+03 MeV/s	
RESULTS			
→ Nuclide	Cs137f	Co60f	Co60f
E Peak (MeV)	0.661657	1.173228	1.332492
Limit E inf of ROI	0.00	1.172	1.331
Limit E sup of ROI	0.664	1.176	1.336
→ Detection Limit (Bq)	8E+08	9.91E+07	5.88E+07
Efficiency	1.51E-09	2.33E-10	2.9E-10
→ REGe No. Screen	3.63E-09	5.03E-10	5.14E-10
→ REGe Screen	1.30E-09	2.94E-09	3.96E-09
→ REGe No Screen	4.30E-08	8.70E-09	6.55E-09

Energy bins (MeV)	Counts at Specified Distance and Time	Counts/s at 10m	Counts at 10m at Specified Time
0.011	3.21E+05	8.90E+01	3.21E+05
0.012	2.01E+05	5.65E+01	2.01E+05
0.013	3.45E+05	9.68E+01	3.45E+05
0.014	2.49E+05	6.91E+01	2.49E+05



CANBERRA™ Solution:

- From the list of around 150 types of drums, 12 “bounding” geometries have been defined, taking into account variety in terms of:
 - Composition and density.
 - Shielding.
 - Internal volume and shape.
- Parametric studies using MCNP calculation code have been performed.
 - For each bounding geometry, one calculation is performed per emitter radionuclide.
 - Automation of the calculations allowed about 600 calculations to be performed in less than one month.
 - Studying up to four measurement configurations in one model made efficient use of the allowed calculation time.
 - This approach allowed a large flexibility in the analysis.
- A specific Excel sheet has been delivered for analysis of results which allows the customer to “build” the detector response of the desired drum, with clear display of the results.
- The measurement configuration has been optimized for the most penalizing drum to be measured using advanced MCNP calculation techniques to allow convergence with highly collimated detectors.

ACHIEVEMENTS

- Complexity problem reduction achieved by the CANBERRA M&E Team for planning and cost optimization.
- Definition of an adaptive measurement system with guarantee of measurement ability for every expected drum.
- Excel sheet reports can be re-used by the customer for further analysis in the next stages of the project without additional cost.
- Civil work cost assessment can be performed based on reliable information.
- On Time Delivery of the final report in spite of the tight schedule thanks to responsiveness of the CANBERRA M&E Experts from various countries.

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