

# Clearance measurements as a tool for waste minimization during decommissioning

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Clearance, exemption or free release of material from regulatory control are three ways of expressing the same thing, minimizing the amount of waste that needs disposal as radioactive waste and therefore preserving a repository as a national asset.

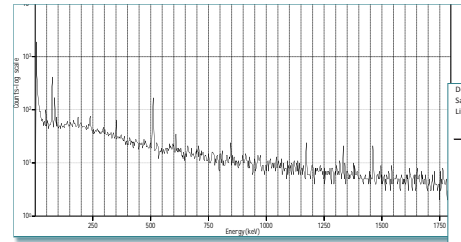
Studsvik Nuclear has utilized the former whole body measurement cell as a shielded compartment used for gamma spectroscopy measurements of materials that may be subject to clearance. The cell was moved from its original position by heavy lifting and transport, as it was transported in one piece weighing 53 tonnes.

## Detector equipment



- HPGe broad energy 50 % relative efficiency.
- ISOCS is used for efficiency calculations and APEX for detector operating.
- Operating – In order to have full control of the equipment, daily quality assurance checks are carried out for control of detector stability and background influences.

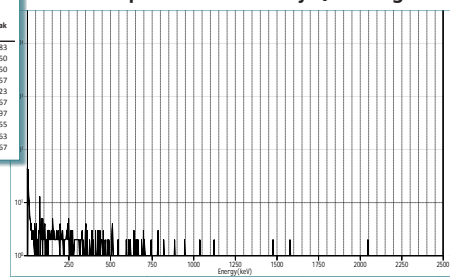
## Complete background spectrum for 60 000 s



## Peak analysis report from background spectrum

Peak No	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert	Continuum Counts	Net Peak cps
3	72.28	0.78	5.27E+02	28.27	4.52E+02	0.008783
4	74.96	0.78	9.15E+02	36	4.97E+02	0.015250
5	84.76	0.91	2.91E+02	37.6	5.18E+02	0.004850
6	236.54	0.93	9.34E+01	31.8	3.88E+02	0.001517
7	351.97	0.83	9.14E+01	27.4	2.78E+02	0.001523
8	510.78	2.71	1.21E+03	47.25	3.40E+02	0.020167
9	609.16	1.29	6.58E+01	22.68	3.89E+02	0.001097
12	1172.97	0.99	9.93E+01	17.64	6.67E+01	0.001655
13	1332.45	1.21	9.38E+01	18.47	6.83E+01	0.001563
14	1460.69	0.79	5.26E+01	12.48	3.90E+01	0.000967

## Spectrum from daily QA background



Acquisition time normally 1200 - 3600 seconds to reach acceptable detection limits of main gamma emitting radionuclides.



## Cell entrance showing the rotating table

- To the left: scale measuring the object's weight.
- The detector distance is 150 cm from table centre, placed for minimizing background.
- During measurement the table is able to rotate.
- Background shielding of 160 mm steel and 3 mm lead lining.

## Standard waste containers used for routine counting

- 1200 or 600 L box (Berglöfs box) 200 L or 100 L steel drum.
- Maximum dimensions: 1140 x 1450 x 1140 mm.
- Maximum weight: 3500 kg.

