SGS | **RADIATION SERVICES**

NATA

WORLD RECOGNISED ACCREDITATION

Accreditation No. 16987
Accredited for compliance with ISO/IEC 17025

Certificate of Calibration

Certificate No.:   CAL-16-12321

A.   Issued to

Company name: SGS Radiation Services
Address: 10 / 585 Blackburn Road
Notting Hill VIC 3168

B.   Instrument and use

Manufacturer: Georadis
Model No.:   RS 220
Serial No.:   1710
Intended use: Gamma ray survey and radionuclide identification

C.   Details of calibration

Previous calibration: 6th October 2015

Date calibrated: 17th October 2016
Type of test: Annual calibration.
Test conditions: Gamma radiation emitting point sources were used to determine the instrument's response to different radionuclides (test method: ARS-SOP-CL6). The response of the instrument to a beam of collimated gamma rays from one or more ^{137}Cs sources was also evaluated (test method: ARS-SOP-CL2).
Test reference point: NaI detector: 40 mm behind base.
Orientation: Horizontal in radiation beam.
Uncertainties: The uncertainties stated on this certificate are expressed with a coverage factor of 2 corresponding to a 95% confidence level.
Traceability: The outputs of all ^{137}Cs sources used to calibrate this instrument are traceable to the Australian Primary Standard of Exposure maintained by ARPANSA.

D.   Calibration results

The instrument over responded by greater than 25% at ambient dose equivalent rates greater than 43.8 μSv·h^{-1}.

Refer to the results on page 2 of this certificate for the response of the instrument at specified test points.

Notes: 1.   Before using this instrument the user should be familiar with its characteristics (energy dependence, directional dependence, etc.).
2.   Any alteration to the electronic settings or damage to the instrument will render the calibration void.

Calibrated by: Mr. Roland Sargent
Position: Senior Technical Officer
Signature:

Reviewed by: Ms. Gillian Nicholson
Position: Senior Technical Officer
Signature:

Date: 17th October 2016

Date: 18th October 2016

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E.   Dose response (^{137}Cs – 662 keV)

Radiation source	Instrument range	Measured ambient dose equivalent rate[a] (μSv·h^{-1})	Actual ambient dose equivalent rate (μSv·h^{-1})	Correction factor[b]	Estimated uncertainty
Background	Auto	0.03[c]	N/A[d]	N/A	N/A
^{137}Cs (3.7 GBq)	Auto	0.28	0.29	1.04	±10%
^{137}Cs (3.7 GBq)	Auto	1.07	1.12	1.05	±10%
^{137}Cs (3.7 GBq)	Auto	2.05	2.12	1.03	±9%
^{137}Cs (3.7 GBq)	Auto	10.9	11.4	1.04	±8%
^{137}Cs (3.7 GBq)	Auto	47.7	43.8	0.92	±6%

a.   Background correction has been applied.
b.   Correction factor is the ratio of the background corrected actual ambient dose equivalent rate to the background corrected measured ambient dose equivalent rate reading.
c.   No background correction applies.
d.   The actual background has been measured in units of air kerma (μGy·h^{-1}) using Health Physics Instruments Model 1010 (SN:419).

F.   Source identification

Source and actual energies (keV) of characteristic peaks	Measured energies (keV) of characteristic peaks[a]	Characteristic peaks identified	Source identified[b]
^{137}Cs (662)	662	Yes	Yes
^{22}Na (511, 1275)	512, 1273	Yes	No[c]
^{133}Ba (81, 303, 356)	80.5, 302, 356	Yes	Yes
^{60}Co (1173, 1333)	1162,1320	Yes	Yes
^{152}Eu (344, 779, 1112, 1408)	341, 770, 1091, 1397	Yes	Yes
^{226}Ra (352, 609, 1120)	349, 604, 1111	Yes	Yes
^{241}Am (60)	58.2	Yes	Yes
^{232}Th (239, 338, 583)	240, 344,589	Yes	Yes

a.   The characteristic peaks are listed as noted from the peak analysis menu of the RS-220.
b.   Custom library used for source identification test.
c.   Radionuclide not in custom library.

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Appendix A: Reference source specifications

Source No.	Radiation source	Activity	Source type	Serial No.	Reference date
1	^{137}Cs	370 MBq	Calibration Source	GN5479	6th March 2007
2	^{137}Cs	3.7 GBq	Calibration Source	GH0466	20th May 2009
3	^{137}Cs	41 GBq	Calibration Source	GN5479	20th May 2009
4	^{137}Cs	145 GBq	Calibration Source	SG781	16th November 2009
5	^{238}Pu	892 Bq	Wide Area	HA 943	19th January 2000
6	^{238}Pu^a	3.61 kBq	Wide Area	LT 178	28th May 2003
7	^{241}Am^b	2.82 kBq	Wide Area	UD 805	28th February 2012
8	^{14}C	2.50 kBq	Wide Area	HM 470	28th September 2000
9	^{99}Tc	1.10 kBq	Wide Area	GF 855	15th October 1998
10	^{36}Cl	1.22 kBq	Wide Area	GF 854	6th October 1998
11	^{90}Sr/^{90}Y	1.19 kBq	Wide Area	HR 157	10th January 2001
12	^{129}I	943 Bq	Wide Area	HM 469	16th October 2000
13	^{210}Pb	223 kBq	Point Source	FZ165	1st October 1998
14	^{241}Am	36.6 kBq	Point Source	FZ159	1st October 1998
15	^{137}Cs	40.0 kBq	Point Source	FZ161	1st October 1998
16	^{60}Co	44.1 kBq	Point Source	FZ162	1st October 1998
17	^{226}Ra	55.7 kBq	Point Source	FZ166	1st October 1998
18	^{22}Na	41.0 kBq	Point Source	FZ164	1st October 1998
19	^{152}Eu	44.4 kBq	Point Source	FZ163	1st October 1998
20	^{133}Ba	38.9 kBq	Point Source	FZ160	1st October 1998
21	^{137}Cs	10 kBq	Point Source	SGS10KBq	13th August 2014
22	^{137}Cs	62 kBq	Point Source	SGS62KBq	13th August 2014
23	^{137}Cs	335 kBq	Point Source	SGS335KBq	13th August 2014
24	^{57}Co	851 kBq	Point Source	1707-99-9	23rd May 2014

a.   This source is used for all ^{238}Pu contamination response testing unless stated otherwise on the calibration certificate.
b.   This source is used for all ^{241}Am contamination response testing unless stated otherwise on the calibration certificate.

Appendix B: Disclaimer