National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 105020-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Pacific Northwest National Laboratory / Battelle	Parameter(s) of Accreditation
Battelle Boulevard P.O. Box 999 Richland, WA 99354 Mr. R. Kim Piper Phone: 509-375-7339 Fax: 509-375-7340 E-mail: kim.piper@pnl.gov URL: http://cra.pnl.gov	Ionizing Radiation This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Uncertainty of Delivered Quantity (k=2) [Note 3]	Remarks
IONIZING RADIATION				
NVLAP Code: 20/I01 DOSIMETRY of X-RAYS, GAMMA RAYS, and ELECTRONS				
Irradiation of Artifacts	(≥ value shown)	(≥ value shown)		
Gamma ^{241}Am	0.02 mGy	0.002 R	5.4 %	
^{137}Cs	0.12 mGy	0.014 R	1.6 %	
^{60}Co	0.0064 mGy	0.00073 R	3.2 %	
X-ray L40	0.29 mGy	0.033 R	2.4 %	
L50	0.29 mGy	0.033 R	2.4 %	
L80	0.37 mGy	0.042 R	2.4 %	
L100	0.44 mGy	0.050 R	2.4 %	
X-ray M20	0.22 mGy	0.025 R	2.4 %	
M30	0.22 mGy	0.025 R	2.4 %	
M40	0.22 mGy	0.025 R	2.4 %	
M50	0.22 mGy	0.025 R	2.4 %	
M60	0.22 mGy	0.025 R	2.4 %	
M100	0.22 mGy	0.025 R	2.4 %	
M150	0.29 mGy	0.033 R	2.4 %	
M200	0.29 mGy	0.033 R	2.4 %	
M250	0.29 mGy	0.033 R	2.4 %	

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Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Uncertainty of Delivered Quantity (k=2) Note 3	Remarks
M300	0.15 mGy	0.017 R	2.4 %	
X-ray H30	0.004 mGy	0.0005 R	2.4 %	
H40	0.002 mGy	0.0002 R	2.4 %	
H50	0.005 mGy	0.0006 R	2.4 %	
H60	0.004 mGy	0.0005 R	2.4 %	
H100	0.002 mGy	0.0002 R	2.4 %	
H150	0.07 mGy	0.008 R	2.4 %	
H200	0.07 mGy	0.008 R	2.4 %	
H250	0.07 mGy	0.008 R	2.4 %	
H300	0.04 mGy	0.005 R	2.4 %	
X-ray S60	0.07 mGy	0.008 R	2.4 %	
S75	0.29 mGy	0.033 R	2.4 %	
X-ray HK30	0.22 mGy	0.025 R	2.4 %	
HK60	0.15 mGy	0.017 R	2.4 %	
HK100	0.15 mGy	0.017 R	2.4 %	
HK200	0.29 mGy	0.033 R	2.4 %	
HK250	0.44 mGy	0.050 R	2.4 %	
HK280	0.44 mGy	0.050 R	2.4 %	
HK300	0.51 mGy	0.058 R	2.4 %	
X-ray WS60	0.02 mGy	0.002 R	2.4 %	
WS80	0.03 mGy	0.003 R	2.4 %	
WS110	0.02 mGy	0.002 R	2.4 %	
WS150	0.04 mGy	0.005 R	2.4 %	
WS200	0.07 mGy	0.008 R	2.4 %	
WS250	0.07 mGy	0.008 R	2.4 %	
WS300	0.07 mGy	0.008 R	2.4 %	
X-ray NS20	0.02 mGy	0.002 R	2.4 %	
NS25	0.008 mGy	0.001 R	2.4 %	
NS30	0.005 mGy	0.0006 R	2.4 %	
NS40	0.003 mGy	0.0003 R	2.4 %	

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Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Uncertainty of Delivered Quantity (k=2) Note 3	Remarks
NS60	0.004 mGy	0.0005 R	2.4 %	
NS80	0.003 mGy	0.0003 R	2.4 %	
NS100	0.002 mGy	0.0002 R	2.4 %	
NS120	0.002 mGy	0.0002 R	2.4 %	
NS150	0.07 mGy	0.008 R	2.4 %	
NS200	0.04 mGy	0.005 R	2.4 %	
NS250	0.04 mGy	0.005 R	2.4 %	
NS300	0.04 mGy	0.005 R	2.4 %	
X-ray LK30	0.0002 mGy	0.00002 R	2.4 %	
LK35	0.0006 mGy	0.00007 R	2.4 %	
LK55	0.0004 mGy	0.00004 R	2.4 %	
LK70	0.0004 mGy	0.00004 R	2.4 %	
LK100	0.0004 mGy	0.00004 R	2.4 %	
LK125	0.0004 mGy	0.00004 R	2.4 %	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source	Nominal Range	Nominal Range	Uncertainty of Delivered Quantity (k=2) Note 3	Remarks
Irradiation of Artifacts	(≥ value shown)	(≥ value shown)		
Beta ^{147}Pm	0.002 mGy	0.0002 rad	5.0 %	
^{85}Kr	0.6 mGy	0.06 rad	3.9 %	
^{204}Tl	0.01 mGy	0.001 rad	3.6 %	
^{90}Sr/^{90}Y	0.03 mGy	0.003 rad	3.6 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Calibration Category and Radiation Type or Beam Code	Nominal Intensity Range	Nominal Intensity Range	Uncertainty of Reference Field (k=2) [Note 3]	Remarks
Calibration of Reference-Class and Survey Instruments				
Gamma ^{241}Am	1.02 mGy/h	0.12 R/h	5.2 %	
^{137}Cs	5 E-5 mGy/h to 0.001 mGy/h	5 E-6 R/h to 1 E-4 R/h	6.2 % to 2.5 %	
^{137}Cs	0.002 mGy/h to 0.05 mGy/h	2 E-4 R/h to 5 E-3 R/h	4.5 % to 2.5 %	
^{137}Cs	0.02 mGy/h to 9.0 mGy/h	0.003 R/h to 0.9 R/h	2.5 % to 3.2 %	
^{137}Cs	15 mGy/h to 1500 mGy/h	1.7 R/h to 170 R/h	1.4 %	
^{60}Co	9.7 mGy/h to 590 000 mGy/h	1.1 R/h to 68 000 R/h	1.4 %	
X-ray L40	40 mGy/h to 6500 mGy/h	4 R/h to 740 R/h	1.5 %	
L50	40 mGy/h to 7400 mGy/h	4 R/h to 840 R/h	1.5 %	
L80	40 mGy/h to 8800 mGy/h	5 R/h to 1000 R/h	1.5 %	
L100	50 mGy/h to 11 000 mGy/h	6 R/h to 1200 R/h	1.5 %	
X-ray M20	30 mGy/h to 5300 mGy/h	3 R/h to 600 R/h	1.5 %	
M30	30 mGy/h to 4400 mGy/h	3 R/h to 500 R/h	1.5 %	
M40	30 mGy/h to 4400 mGy/h	3 R/h to 500 R/h	1.5 %	
M50	30 mGy/h to 6100 mGy/h	3 R/h to 700 R/h	1.5 %	
M60	30 mGy/h to 5300 mGy/h	3 R/h to 600 R/h	1.5 %	
M100	30 mGy/h to 5300 mGy/h	3 R/h to 600 R/h	1.5 %	
M150	40 mGy/h to 7000 mGy/h	4 R/h to 800 R/h	1.5 %	
M200	40 mGy/h to 5700 mGy/h	4 R/h to 650 R/h	1.5 %	
M250	40 mGy/h to 4400 mGy/h	4 R/h to 500 R/h	1.5 %	
M300	20 mGy/h to1500 mGy/h	2 R/h to 175 R/h	1.5 %	
X-ray H30	0.5 mGy/h to 100 mGy/h	0.06 R/h to 12 R/h	1.5 %	
H40	0.2 mGy/h to 40 mGy/h	0.02 R/h to 5 R/h	1.5 %	
H50	0.6 mGy/h to 110 mGy/h	0.07 R/h to 13 R/h	1.5 %	
H60	0.5 mGy/h to 110 mGy/h	0.06 R/h to 13 R/h	1.5 %	
H100	0.2 mGy/h to 30 mGy/h	0.02 R/h to 3 R/h	1.5 %	
H150	9 mGy/h to 200 mGy/h	1 R/h to 21 R/h	1.5 %	
H200	9 mGy/h to 100 mGy/h	1 R/h to 14 R/h	1.5 %	
H250	8 mGy/h to 90 mGy/h	0.9 R/h to 10 R/h	1.5 %	

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Calibration Category and Radiation Type or Beam Code	Nominal Intensity Range	Nominal Intensity Range	Uncertainty of Reference Field (k=2) [Note 3]	Remarks
H300	5 mGy/h to 50 mGy/h	0.6 R/h to 6 R/h	1.5 %	
X-ray S60	9 mGy/h to 2000 mGy/h	1 R/h to 230 R/h	1.5 %	
S75	40 mGy/h to 7700 mGy/h	4 R/h to 880 R/h	1.5 %	
X-ray HK30	30 mGy/h to 4400 mGy/h	3 R/h to 500 R/h	1.5 %	
HK60	20 mGy/h to 2600 mGy/h	2 R/h to 300 R/h	1.5 %	
HK100	20 mGy/h to 3500 mGy/h	2 R/h to 400 R/h	1.5 %	
HK200	40 mGy/h to 5300 mGy/h	4 R/h to 600 R/h	1.5 %	
HK250	50 mGy/h to 7000 mGy/h	6 R/h to 800 R/h	1.5 %	
HK280	50 mGy/h to 5300 mGy/h	6 R/h to 600 R/h	1.5 %	
HK300	60 mGy/h to 7000 mGy/h	7 R/h to 800 R/h	1.5 %	
X-ray WS60	2 mGy/h to 350 mGy/h	0.2 R/h to 40 R/h	1.5 %	
WS80	3 mGy/h to 600 mGy/h	0.3 R/h to 68 R/h	1.5 %	
WS110	2 mGy/h to 440 mGy/h	0.2 R/h to 50 R/h	1.5 %	
WS150	5 mGy/h to 900 mGy/h	0.6 R/h to 100 R/h	1.5 %	
WS200	9 mGy/h to 1400 mGy/h	1 R/h to 160 R/h	1.5 %	
WS250	9 mGy/h to 1400 mGy/h	1 R/h to 160 R/h	1.5 %	
WS300	9 mGy/h to 1500 mGy/h	1 R/h to 170 R/h	1.5 %	
X-ray NS20	2 mGy/h to 350 mGy/h	0.2 R/h to 40 R/h	1.5 %	
NS25	0.9 mGy/h to 260 mGy/h	0.1 R/h to 30 R/h	1.5 %	
NS30	0.6 mGy/h to 130 mGy/h	0.07 R/h to 15 R/h	1.5 %	
NS40	0.4 mGy/h to 70 mGy/h	0.04 R/h to 8 R/h	1.5 %	
NS60	0.5 mGy/h to 120 mGy/h	0.06 R/h to 14 R/h	1.5 %	
NS80	0.3 mGy/h to 60 mGy/h	0.03 R/h to 7 R/h	1.5 %	
NS100	0.2 mGy/h to 40 mGy/h	0.02 R/h to 4 R/h	1.5 %	
NS120	0.2 mGy/h to 40 mGy/h	0.02 R/h to 4 R/h	1.5 %	
NS150	9 mGy/h to 250 mGy/h	1 R/h to 28 R/h	1.5 %	
NS200	5 mGy/h to 70 mGy/h	0.6 R/h to 8 R/h	1.5 %	
NS250	5 mGy/h to 60 mGy/h	0.6 R/h to 7 R/h	1.5 %	
NS300	5 mGy/h to 50 mGy/h	0.6 R/h to 6 R/h	1.5 %	

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X-ray	LK30	0.02 mGy/h to 4 mGy/h	0.002 R/h to 0.4 R/h	1.5 %	
	LK35	0.07 mGy/h to 20 mGy/h	0.008 R/h to 2 R/h	1.5 %	
	LK55	0.04 mGy/h to 9 mGy/h	0.005 R/h to 1 R/h	1.5 %	
	LK70	0.04 mGy/h to 9 mGy/h	0.005 R/h to 1 R/h	1.5 %	
	LK100	0.04 mGy/h to 9 mGy/h	0.005 R/h to 1 R/h	1.5 %	
	LK125	0.04 mGy/h to 9 mGy/h	0.005 R/h to 1 R/h	1.5 %	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source	Nominal Intensity Range	Nominal Intensity Range	Uncertainty of Reference Field (k=2) Note 3	Remarks
Calibration of Reference-Class and Survey Instruments				
Beta ^{147}Pm	0.2 mGy/h	0.02 rad/h	1.5 %	
^{85}Kr	70 mGy/h	7 rad/h	1.4 %	
^{204}Tl	1.0 mGy/h	0.1 rad/h	3.3 %	
^{90}Sr/^{90}Y	3 mGy/h to 140 mGy/h	0.3 rad/h to 14 rad/h	3.3 %	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source	Nominal Range Note 9	Nominal	Uncertainty of Delivered Quantity (k=2) Note 3, 8	Remarks
NVLAP Code: 20/I03 NEUTRON SOURCES and DOSIMETERS				
Irradiation of Artifacts	(≥ value shown)	(≥ value shown)		
Neutron ^{252}Cf Bare	0.26 mSv	0.0026 rem	8.5 %	
^{252}Cf Moderated	0.074 mSv	0.0074 rem	11 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Radiation Type and Source	Nominal Intensity Range [Note 9]	Nominal Intensity Range	Uncertainty of Reference Field (k=2) [Note 3, 8]	Remarks
Calibration of Reference-Class and Survey Instruments				
Neutron ^{252}Cf Bare	0.022 mSv/h to 2.2 mSv/h	0.0022 rem/h to 0.22 rem/h	8 % to 9 %	
	0.44 mSv/h to 44 mSv/hr	0.044 rem/h to 44 rem/h	4.4 % to 4.7 %	
^{252}Cf Moderated	0.0058 mSv/h to 0.58 mSv/h	0.00058 rem/h to 0.058 rem/h	12 % to 13 %	
	0.12 mSv/h to 12 mSv/h	0.012 rem/h to 1.2 rem/h	4.5 % to 4.7 %	
END				

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Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions*. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

Note 7: See NIST Handbook 150 for further explanation of these notes.

Note 8: Estimated uncertainty addresses only the neutron personal dose equivalent (i.e., photon contribution is not considered.) For Irradiation of Artifacts, the reported uncertainty estimate addresses unaccounted dose attributed to scattered neutrons at the reference dose point.

Note 9: Provides free-field neutron dose in terms of Personal Dose Equivalent, Hp(10), determined on the basis of using fluence-to-dose equivalent conversion coefficients as a function of neutron energy as given in ICRP-74 and ICRU Report 57.

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