



National Voluntary Laboratory Accreditation Program



CALIBRATION LABORATORIES

NVLAP LAB CODE 105020-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

<p>Pacific Northwest National Laboratory / Battelle Battelle Boulevard P.O. Box 999 Richland, WA 99352 Mr. R. Kim Piper Phone: 509-375-7339 Fax: 509-375-7340 E-mail: kim.piper@pnnl.gov URL: http://cra.pnnl.gov</p>	<p>Fields of Calibration Ionizing Radiation</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1.</p>
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Expanded Uncertainty of Delivered Quantity ^{Note 3}	Remarks
IONIZING RADIATION				
DOSIMETRY of X-RAYS, GAMMA RAYS, and ELECTRONS (20/I01)				
Irradiation of Artifacts	(≥ value shown)	(≥ value shown)		
Gamma ²⁴¹ Am	0.02 mGy	0.002 R	5.4 %	
¹³⁷ Cs	0.12 mGy	0.012 R	1.6 %	
⁶⁰ Co	0.0038 mGy	0.00043 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 %	
M300	0.15 mGy	0.017 R	2.4 %	

2017-01-27 through 2017-12-31

Effective dates

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Laboratory Accreditation Program**



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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Expanded Uncertainty of Delivered Quantity^{Note 3}	Remarks
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 %	
NS60	0.004 mGy	0.0005 R	2.4 %	

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Radiation Type and Source or Beam Code	Nominal Range in Air Kerma	Nominal Range in Exposure	Expanded Uncertainty of Delivered Quantity ^{Note 3}	Remarks
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 in Absorbed Dose to Tissue, Dp(0.07mm)	Nominal Range in Absorbed Dose to Tissue, Dp(0.07mm)	Expanded Uncertainty of Delivered Quantity ^{Note 3}	Remarks
Irradiation of Artifacts	(≥ value shown)	(≥ value shown)		
Beta ⁸⁵ Kr	0.4 mGy	0.04 rad	3.9 %	
⁹⁰ Sr/ ⁹⁰ Y	0.02 mGy	0.002 rad	3.6 %	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Calibration Category and Radiation Type or Beam Code	Nominal Intensity Range in Air Kerma Rate	Nominal Intensity Range in Exposure Rate	Expanded Uncertainty of Reference Field ^{Note 3}	Remarks
Calibration of Reference-Class and Survey Instruments				
Gamma ²⁴¹ Am	1.02 mGy/h	0.12 R/h	5.2 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Calibration Category and Radiation Type or Beam Code	Nominal Intensity Range in Air Kerma Rate	Nominal Intensity Range in Exposure Rate	Expanded Uncertainty of Reference Field ^{Note 3}	Remarks
¹³⁷ Cs	4 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 0.04 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 7.0 mGy/h	0.002 R/h to 0.8 R/h	2.5 % to 3.2 %	
¹³⁷ Cs	0.5 mGy/h to 1700 mGy/h	0.06 R/h to 190 R/h	1.7 % to 2.3 %	
⁶⁰ Co	5.8 mGy/h to 350 000 mGy/h	0.66 R/h to 40 000 R/h	1.2 % to 2.0 %	
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 to 1500 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 %	
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 %	

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Calibration Category and Radiation Type or Beam Code	Nominal Intensity Range in Air Kerma Rate	Nominal Intensity Range in Exposure Rate	Expanded Uncertainty of Reference Field ^{Note 3}	Remarks
X-ray HK30 HK60 HK100 HK200 HK250 HK280 HK300	30 mGy/h to 4400 mGy/h	3 R/h to 500 R/h	1.5 %	
	20 mGy/h to 2600 mGy/h	2 R/h to 300 R/h	1.5 %	
	20 mGy/h to 3500 mGy/h	2 R/h to 400 R/h	1.5 %	
	40 mGy/h to 5300 mGy/h	4 R/h to 600 R/h	1.5 %	
	50 mGy/h to 7000 mGy/h	6 R/h to 800 R/h	1.5 %	
	50 mGy/h to 5300 mGy/h	6 R/h to 600 R/h	1.5 %	
	60 mGy/h to 7000 mGy/h	7 R/h to 800 R/h	1.5 %	
X-ray WS60 WS80 WS110 WS150 WS200 WS250 WS300	2 mGy/h to 350 mGy/h	0.2 R/h to 40 R/h	1.5 %	
	3 mGy/h to 600 mGy/h	0.3 R/h to 68 R/h	1.5 %	
	2 mGy/h to 440 mGy/h	0.2 R/h to 50 R/h	1.5 %	
	5 mGy/h to 900 mGy/h	0.6 R/h to 100 R/h	1.5 %	
	9 mGy/h to 1400 mGy/h	1 R/h to 160 R/h	1.5 %	
	9 mGy/h to 1400 mGy/h	1 R/h to 160 R/h	1.5 %	
	9 mGy/h to 1500 mGy/h	1 R/h to 170 R/h	1.5 %	
X-ray NS20 NS25 NS30 NS40 NS60 NS80 NS100 NS120 NS150 NS200 NS250 NS300	2 mGy/h to 350 mGy/h	0.2 R/h to 40 R/h	1.5 %	
	0.9 mGy/h to 260 mGy/h	0.1 R/h to 30 R/h	1.5 %	
	0.6 mGy/h to 130 mGy/h	0.07 R/h to 15 R/h	1.5 %	
	0.4 mGy/h to 70 mGy/h	0.04 R/h to 8 R/h	1.5 %	
	0.5 mGy/h to 120 mGy/h	0.06 R/h to 14 R/h	1.5 %	
	0.3 mGy/h to 60 mGy/h	0.03 R/h to 7 R/h	1.5 %	
	0.2 mGy/h to 40 mGy/h	0.02 R/h to 4 R/h	1.5 %	
	0.2 mGy/h to 40 mGy/h	0.02 R/h to 4 R/h	1.5 %	
	9 mGy/h to 250 mGy/h	1 R/h to 28 R/h	1.5 %	
	5 mGy/h to 70 mGy/h	0.6 R/h to 8 R/h	1.5 %	
	5 mGy/h to 60 mGy/h	0.6 R/h to 7 R/h	1.5 %	
	5 mGy/h to 50 mGy/h	0.6 R/h to 6 R/h	1.5 %	
	X-ray LK30 LK35 LK55 LK70 LK100	0.02 mGy/h to 4 mGy/h	0.002 R/h to 0.4 R/h	
0.07 mGy/h to 20 mGy/h		0.008 R/h to 2 R/h	1.5 %	
0.04 mGy/h to 9 mGy/h		0.005 R/h to 1 R/h	1.5 %	
0.04 mGy/h to 9 mGy/h		0.005 R/h to 1 R/h	1.5 %	
0.04 mGy/h to 9 mGy/h		0.005 R/h to 1 R/h	1.5 %	

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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 in Absorbed Dose Rate to Tissue, Dp(0.07mm)	Nominal Intensity Range in Absorbed Dose Rate to Tissue, Dp(0.07mm)	Expanded Uncertainty of Reference Field ^{Note 3}	Remarks
Calibration of Reference-Class and Survey Instruments Beta ⁸⁵ Kr ⁹⁰ Sr/ ⁹⁰ Y	50 mGy/h 23 mGy/h to 140 mGy/h	5 rad/h 2.3 rad/h to 14 rad/h	1.4 % 3.3 %	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source	Nominal Range in Neutron Personal Dose Equivalent, Hp(10mm) ^{Note 8}	Nominal Range in Neutron Personal Dose Equivalent, Hp(10mm)	Expanded Uncertainty of Delivered Quantity ^{Note 3, 8}	Remarks
NEUTRON SOURCES and DOSIMETERS (20/I03)				
Irradiation of Artifacts Neutron ²⁵² Cf Bare ²⁵² Cf Moderated	(≥ value shown) 0.05 mSv 0.01 mSv	(≥ value shown) 0.005 rem 0.001 rem	8.5% 11%	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Radiation Type and Source	Nominal Intensity Range in Neutron Ambient Dose Equivalent Rate, H*(10mm) ^{Note 8}	Nominal Intensity Range in Neutron Ambient Dose Equivalent Rate, H*(10mm)	Expanded Uncertainty of Reference Field ^{Note 3, 8}	Remarks
Calibration of Reference-Class and Survey Instruments Neutron ²⁵² Cf Bare	0.001 mS/h to 1.3 mSv/h	0.0001 rem/h to 0.13 rem/h	8% to 9%	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Radiation Type and Source	Nominal Intensity Range in Neutron Ambient Dose Equivalent Rate, H*(10mm) ^{Note 8}	Nominal Intensity Range in Neutron Ambient Dose Equivalent Rate, H*(10mm)	Expanded Uncertainty of Reference Field ^{Note 3, 8}	Remarks
²⁵² Cf Moderated	0.16 mSv/h to 210 mSv/h.	0.016 rem/h to 21 rem/h	4.4% to 4.7%	
	0.001 mSv/h to 0.38 mSv/h	0.0001 rem/h to 0.038 rem/h	12% to 13%	
	0.05 mSv/h to 61 mSv/h	0.005 rem/h t 6.1 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 with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. 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: 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 8: 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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