

**Enclosure**

**OAK RIDGE ASSOCIATED UNIVERSITIES:  
SITE STATUS REPORT FOR THE FORMER SESSIONS CLOCK COMPANY AT  
61 EAST MAIN STREET, BRISTOL, CONNECTICUT**

**[AUGUST 16, 2017]**

## EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) requested that the Oak Ridge Associated Universities (ORAU) perform a radiological survey of the property at 61 East Main Street in Bristol, Connecticut. This property covers the footprint once occupied by the former Sessions Clock Company, which used radium paint in the manufacturing of clocks and watches at least through the 1940s. The original buildings are intact and currently owned by FIC, LLC. The objective of this survey was to locate possible discrete sources of radium, if any, that would be associated with former Sessions Clock Company operations.

ORAU performed the radiation survey of the building interiors December 19 through 21, 2016, and exterior land areas on February 1, 2017, and did identify elevated levels of radiation due to radium-226 on the fourth floor of Building B and the third floor of Building D. Because elevated levels of radiation were identified associated with radium-226, ORAU concluded that discrete sources of radium are present, though current site uses and reasonably foreseeable site uses (i.e., manufacturing, storage, or potential residential use) are unlikely to result in an unacceptable dose to occupants. It is recommended that the NRC not perform a scoping survey because such a survey is not expected to provide additional information needed to make a decision on whether site cleanup is needed. Based on the dose assessment considerations, and observations above, doses will not exceed 25 millirem per year for current uses and reasonably foreseeable future uses.



## SITE STATUS REPORT

Property: Former Sessions Clock Factory  
61 East Main Street  
Bristol, CT 06010

Docket Number: 3038971

Current Property Name(s): FIC, LLC

Current Property Owner(s): FIC, LLC

Inspection Dates: December 19 through 21, 2016 and February 1, 2017

Inspector(s): Orysia Bailey and Katherine Warner/U.S. Nuclear Regulatory Commission (NRC), supported by Nick Altic and Jason Lee /Oak Ridge Associated Universities (ORAU) (December 2016); Ray Powell and Briana DeBoer/NRC, supported by Kaitlin Engel and Stephen Pittman /ORAU (February 2017)

### 1.0 INTRODUCTION

The Energy Policy Act of 2005 amended section 11e.(3) of the Atomic Energy Act of 1954 to place discrete sources of radium-226 (Ra-226) under NRC regulatory authority as byproduct material. The NRC is evaluating properties where review of historical information has identified Ra-226 use. The property at 61 East Main Street in Bristol, Connecticut, was identified as the former Sessions Clock Company, a former manufacturing facility, which operated from the 1920s to the mid-1940s (ORNL 2015). Additional information is also available in the data for former watch manufacturers in Connecticut report (DEEP 1998), the Agency for Toxic Substances and Disease Registry (ATSDR) report (ATSDR 1999), and the Scientech report (Scientech 2003). These reports do not indicate that cleanup was previously completed. The objectives of the initial site visit were to determine if discrete sources of Ra-226 and/or distributed Ra-226 contamination are present, to identify the areas of highest contamination, to determine if there are any current health and safety concerns, and to determine if a more in-depth scoping survey is needed to better reach a conclusion on whether site cleanup is necessary.

Data collected during the initial site visit is used to plan future actions that may be needed to reduce the exposure of Ra-226 to current or future site occupants to levels that do not exceed the applicable regulatory requirement. It is important to note that destructive testing is not generally performed as described within NRC's procedures, Temporary Instruction 2800/043 "Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources" (NRC 2016).

## 2.0 PROPERTY DESCRIPTION AND INITIAL SITE VISIT CONSIDERATIONS

### 2.1 Property Description and History

The former Sessions Clock Factory complex consists of the seven factory buildings still standing, the original two-story office building, a boiler building, and a two-bay truck garage. Construction of this complex began in 1899 and was completed by April of 1900 (Harveson 2017). In 1903, the Sessions Clock Company began operation and produced mantle and kitchen clocks. Radium paint was used to paint clock dials from, it is believed, the early 1900s through the 1940s. In 1958, the company was sold, and the new company continued to produce clocks until 1968. In 1960, one of the buildings was sold to the Bristol Instrument Gears Company, the investigation of which is covered under a separate site visit. Figure 1 shows Buildings A, B, C, D, E, J, P, U, V, W and X. The Bristol Instrument Gears Company building, located to the north of the Pequabuck River, is not pictured and is not part of this site status report. The following companies were housed in the Sessions Clock Company buildings in 1999: Dabko Co., NuTECH (first floor of Building A and second floor of Building B), CT Graphics (first floor of Building D), and C&R Printing (second floor of Building X) (ORNL 2015). The present use of each building varies widely from manufacturing to personal storage with several vacant areas.



**Figure 1. Aerial Photo of the Sessions Clock Company at 61 East Main Street**

### 2.2 Initial Site Visit Considerations

Prior to commencing survey activities, the general building layouts were examined for consistency with historical information and to identify impediments to conducting the survey and/or health and safety considerations. The buildings investigated appear to be original, and the structural integrity is sound, including floors, walls, etc.

In the time available for the initial site visit, the inspection team focused on radiological investigations in areas expected to have the highest potential for containing discrete sources of radiation, based on historical knowledge. The selected building areas included interior locations where radium paint was used and exterior grounds where radium materials may have been stored, spilled, or would have otherwise come into contact with the outdoor environment. ATSDR 1999 reported elevated radiation levels in Building D (40  $\mu\text{R}/\text{h}$ ) and Building A (120  $\mu\text{R}/\text{h}$ ); the report also stated that “none of the radiation levels detected pose an immediate health problem.” Sciencetech 2003 also reported a maximum gamma measurement of 30,000 counts per minute (cpm) on the fourth floor of Building B (background was reported at 8,000 cpm). In anticipation of a pending remedial action, Sciencetech 2003 also stated the following:

*Remediation will consist of limited wall and floor scarification or shaving to remove contamination. These areas are currently unoccupied, and minimal restoration work is expected because of the low level of contamination and the remediation that is anticipated.*

NRC was unable to obtain any records confirming that remediation was previously completed.

### 3.0 SITE OBSERVATIONS AND FINDING

#### 3.1 Summary of Activities

The inspection team conducted radiological survey activities during the initial site visit to the 61 East Main Street property from December 19–December 21, 2016. A pre-inspection meeting was held with David Albert (FIC representative), Mike Firsick (Connecticut Department of Energy and Environmental Protection [CT DEEP]), Jeff Semancik (CT DEEP), Katherine Warner (NRC), and Orysia Bailey (NRC). Participants discussed the inspection team’s intention to re-visit some of the locations identified in the historical assessment as potentially contaminated with radium and to perform general area scans in other areas of the facility.

The inspection team was granted general access to all parts of the property, indoors and outdoors. While the floor space in some buildings was used to house equipment and materials (see Appendix A), surveyors were able to maneuver around and between the items to collect representative radiation measurements. Approximately 30% of the accessible floor area of Buildings A and B were surveyed; approximately 50% of the accessible floor area of Buildings C, D, V, W, and X were surveyed; approximately 75% of the accessible floor area in Building J was surveyed; and approximately 20% of the accessible floor area in Building U was surveyed (please see Figure 1). Building E was not surveyed due to it not being part of the original Former Sessions Clock Company, and Building P was unoccupied and deemed to be unsafe to enter.

Radiological surveys consisted of gamma radiation scans within the building using a Ludlum model 44-10 2-in by 2-in sodium iodide (NaI) detector (2×2) connected to a Ludlum model 2221 ratemeter/scaler, alpha-plus-beta radiation direct measurements using a Ludlum model 44-142 plastic scintillator connected to a Ludlum model 2221 ratemeter/scaler, and exposure rate measurements using a Ludlum model 192 NaI-based microRoentgen ( $\mu\text{R}$ ) ratemeter. Exposure

rate measurements were evaluated against an action level of 40  $\mu\text{R}^1/\text{h}$  at 1 meter (m), above background, as specified in Temporary Instruction 2800/043 (NRC 2016). Gamma spectroscopy measurements were made with a Ludlum Model 702i radiation isotope identifier. Smear samples were also collected at selected locations to quantify the removable contaminant fractions. Gamma radiation scans and dose rate measurements were also performed on the exterior perimeter land areas. Table 1 presents the specific instruments used during the site visit. Exposure rate data were recorded on building floor plans provided by the property owner.

<b>Table 1. Sessions Survey Instruments</b>			
<b>Radiation Type (units)</b>	<b>Detector Type</b>	<b>Detector Model (Number)</b>	<b>Ratemeter (Number)</b>
Alpha plus beta (cpm)	Plastic Scintillator <sup>a</sup>	44-142 (920)	2221 (1143)
Gross gamma (cpm)	Sodium Iodide	44-10 (664)	2221 (1143)
Gross gamma (cpm)	Sodium Iodide	44-10 (908)	2221 (590)
Gross gamma exposure meter ( $\mu\text{R}/\text{h}$ )	Sodium Iodide	N/A	192 (1129)
Gamma Spectrum (N/A)	Sodium Iodide	702 <sup>b</sup>	N/A

N/A = not applicable

Number = ORAU equipment tracking number

<sup>a</sup>Though traditionally used for beta radiation detection, ORAU has calibrated the detector for measuring both alpha and beta radiation.

<sup>b</sup>Property of NRC

Select photos collected during the site visit are presented in Appendix A.

#### Summary of Daily Activities – December 19, 2016

The inspection team met with members of CT DEEP, NRC, and the site owner to discuss survey plans for the week. The site visit began with surveys in Building X. Elevated gamma readings were identified in the bathrooms of Building X. These elevated readings were due to naturally occurring radioactive material (NORM) present in the tile and not due to Ra-226. No other anomalies were identified in Building X. Surveys were performed in Building W, and no anomalies were identified. Surveys were initiated on the third floor of Building D. Surface scans identified one area of elevated direct gamma radiation in the studio on the south end of the building, which was confirmed to be a discrete source of Ra-226.

#### Summary of Daily Activities – December 20, 2016

Activities began with surveys of Building A and B. Surveys began on the fourth floor, and progressed to lower floors. One area of elevated gamma radiation was identified on the first

<sup>1</sup>Roentgen (R) is a unit of exposure (energy absorbed in air), whereas a rem is a unit of dose delivered to a person (resulting from the radiation energy absorbed in that person). While Roentgen and rem are related, these are different units. Because they are similar for gamma ray energies from Ra-226, NRC makes the simplifying assumption in this case that these units are equivalent (1 Roentgen = 1 rem).

floor of Building A, which housed a business that makes arts and crafts out of pottery. The elevated gamma readings were attributed to NORM present in the pottery and not to Ra-226. No other areas of elevated direct gamma radiation were observed in Building A. Four total areas of elevated direct gamma radiation were identified on the fourth floor of Building B. The NRC inspector performed a gamma spectrum measurement on the elevated location in the hall of Building B, which was confirmed to be a discrete source of Ra-226. While gamma spectrum measurements were not collected at the other three locations, Ra-226 contamination is suspected based on visual inspection of the construction materials. The elevated gamma radiation at the other three locations was not influenced by construction materials traditionally containing NORM such as tile, brick, or granite. Other than on the fourth floor, no other anomalies were identified. Surveys on the second floor of Building J were initiated and continued into the next day.

#### Summary of Daily Activities – December 21, 2016

Surveys were initiated and completed in Buildings C and V. Additionally, surveys in Building J were completed. No anomalies were identified.

#### Summary of Daily Activities – February 1, 2017

Gamma walkover scans of the outdoor land areas were performed using the NaI 2×2 detectors. High density scans—defined as approximately 100% coverage—focused on the land areas extending 1-2 m from each building perimeter. One exception was the north side of the property near the creek. The terrain precluded the surveyors from accessing the land area north of Buildings X and W. Additionally, the grass area on the south side of the property, between the sidewalk and E. Main Street, was scanned with approximately 100% coverage. Though 100% of accessible areas around building perimeters and grassy areas were surveyed, the total site coverage is estimated to be from 10-20%. Two areas of elevated gamma radiation were identified at the entrances of Building J. The elevated gamma readings were attributed to NORM contained in the granite stairs and not to Ra-226. No other anomalies were identified during the gamma walkover scans.

### 3.2 Summary of Results

Appendix B provides floorplans containing the radiological survey data generated during the site visits. Gamma measurements collected during the Sessions site visits are summarized in Table 2 below. Exposure rate measurements presented in Table 2 represent values collected at 1 meter, or approximately waist height. These exposure rate values include background contributions.

<b>Building</b>	<b>Gamma (kcpm)<sup>a</sup></b>	<b>Exposure Rate (µR/h)<sup>b</sup></b>
A	6 to 21	4 to 17
B	5.8 to 31	5 to 15
C	5 to 16	5 to 10
D	5 to 23	7 to 14
J	8 to 14	8 to 14
U	6 to 13	5 to 10
V	5.5 to 12	5 to 8
W	4 to 16	3 to 15
X	5 to 18	4 to 20
Land	6 to 30	5 to 12

<sup>a</sup>Values in thousand counts per minute

<sup>b</sup>Value represents exposure rate at 1 m

A summary of all locations identified as having elevated direct gamma radiation attributed to Ra-226 and not material containing NORM, as identified during gamma scans, is provided in Table 3. In total, five locations were identified as having elevated exposure rates, none of which were above the 40 µR/h TI threshold. The highest exposure rate measurement was 35 µR/h (gross), which was made on contact with the fourth floor in Building B. All areas of identified contamination were small, discrete locations of an area no larger than 100 cm<sup>2</sup>.

<b>Building</b>	<b>Area<sup>a</sup></b>	<b>Nal (cpm)</b>	<b>Exposure Rate (µR/h)<sup>b</sup></b>	
			<b>Contact</b>	<b>1 m</b>
B	4th Floor (p B-8)	20,000	18	12
B	4th Floor (p B-8)	21,000	20	10
B	4th Floor (p B-8)	31,000	35	15
B	4th Floor (p B-8)	21,000	20	--
D	3rd Floor (p B-13)	23,000	20	11

<sup>a</sup>Parenthetical represents corresponding page number in Appendix B.

<sup>b</sup>Values are gross and include background contribution, which varied from 5 to 15 uR/hr in Buildings B and D.

### Building A

One area of elevated gamma radiation was identified on the first floor of Building A, Location 2 on page B-1, where a room was used to make pottery. The 2×2 response from the pottery was fairly uniform and not discrete, which indicated the presence of NORM in the pottery. Surveys performed in Building A did not identify any additional areas of direct gamma radiation distinguishable from ambient background. Historical survey data indicates that Ra-226

contamination was once present on the fourth floor. However, discussions with a building occupant revealed that this area was previously decontaminated.

### Building B

Four areas of elevated direct gamma radiation were identified in Building B, all of which were located on the fourth floor. The highest exposure rate reading (see photo A-1) was 35 uR/h on contact, including a background contribution of 9 µR/h, and is below the NRC's threshold for implementing controls of 40 µR/h above background. The 2×2 response at the location was 31,000 cpm, which is similar to the 30,000 cpm value previously reported (Scientech 2003). The discrepancy may be due to the fact that measurement locations were not precisely the same. The gamma spectrum measurement using the NRC inspector's Model 702i at this location positively identified Ra-226 with a 94% confidence.

### Building D

One area of radium contamination was identified on the third floor in Building D (see photo A-2). This location had an exposure rate reading of 20 uR/h on contact, including a background contribution of 9 µR/h, and is lower than the NRC's threshold for implementing controls of 40 µR/h above background. A previous report (ATSDR 1999) identified a maximum exposure rate of 40 uR/h, which may be associated with the same location. It is unknown whether the location identified by the ATSDR was remediated to any degree.

### Building X

Elevated gamma radiation was identified in the bathrooms of Building X (see Location 16 on page B-24 and Location 9 of page B-25). The 2×2 response was fairly uniform and not discrete indicating the presence of NORM associated with the tile on the walls and floor instead of Ra-226 discrete sources.

### Exterior Land Area

Elevated gamma radiation was identified on the outside of Building J (see Locations 3 and 10 on pages B-27 and B-28). The 2×2 response was fairly uniform and not discrete indicating the presence of NORM in the granite stairs instead of Ra-226 discrete sources.

### Surface Activity Measurements

The alpha-plus-beta static measurements were converted to total surface activity units of disintegrations per minute per 100 cm<sup>2</sup> (dpm/100 cm<sup>2</sup>) using the equation below:

$$dpm/100\text{ cm}^2 = \frac{C - B}{\epsilon_{tot} \times G}$$

Where:

C = measured count rate (cpm),

B = background count rate (cpm),

G = geometry factor (unitless) =  $\frac{\text{Physical Detector Area (cm}^2\text{)}}{100\text{ cm}^2}$  = 1.00, and

$\epsilon_{tot}$  = total weighted efficiency (unitless) = 1.6.

Due to the number of emissions from Ra-226 and its associated progeny, multiple radiation particles are counted during the surface activity measurement. Therefore, a total weighted efficiency for Ra-226 and its associated progeny was calculated by:

$$\epsilon_{tot} = \sum_n F_n \times \epsilon_{i,n} \times \epsilon_{s,n}$$

Where:

$F_n$  = fractional abundance of  $n^{\text{th}}$  emission,

$\epsilon_{i,n}$  = instrument efficiency for  $n^{\text{th}}$  emission, and

$\epsilon_{s,n}$  = surface efficiency (0.25 for alpha and low-energy beta particles, 0.5 for high-energy beta particles) for  $n^{\text{th}}$  emission.

Total and removable surface activity levels are presented in Table 4. The highest surface activity measurement was collected from the floor in the hallway of the fourth floor in Building B. The floor at this location appeared to be the original surface. The highest removable activity of all smears collected was 3 dpm/100 cm<sup>2</sup> (beta), which is below the analytical minimum detectable concentration, indicating that contamination is not readily removable in the current configuration. Total surface activity was calculated with an efficiency assuming surface contamination and no radon loss. Using these surface activity values during future dose assessments may not be appropriate.

Building	Area <sup>a</sup>	Smear ID	Gross Count (cpm)	Surface Activity (dpm/100 cm <sup>2</sup> ) <sup>b</sup>			
				Total		Removable	
				Alpha+Beta	Alpha	Beta	
B	4th Floor (p B-8)	R0060	943	350	2	3	
B	4th Floor (p B-8)	R0061	1,072	430	2	0	
B	4th Floor (p B-8)	R0062	1,874	930	0	3	
B	4th Floor (p B-8)	R0063	3,023	1,700	0	3	
D	3rd Floor (p B-13)	R0064	1,005	390	0	-1	

<sup>a</sup>Parentetical represents corresponding page number in Appendix B

cpm = counts per minute

<sup>b</sup>dpm/100 cm<sup>2</sup> = disintegrations per minute to 100 square centimeters

### 3.3 Summary of Dose Assessment Results

Exposure rate measurements, whether on contact or at 1-m, were not found to be above the NRC's 40 µR/h threshold for implementing controls, suggesting that potential doses would not, based on external gamma radiation alone, exceed NRC's 100 mrem/yr public dose limit as discussed in the TI (NRC 2016).

Consideration of external exposure pathways alone is appropriate because other exposure pathways are not expected to be significant contributors. First, the potential inhalation dose is



not expected to be more than a few mrem/yr based on DandD Version 2.4 calculations (NRC 2001)<sup>i</sup>. Second, the potential secondary ingestion exposure is not expected to be significant because measurements of removable contamination indicate that the existing removable contamination (<1% removable) is less than the percentage assumed in typical screening analyses for an industrial building occupant screening scenario (i.e., 10%). Therefore, the contamination is largely fixed and not significantly removable<sup>ii</sup>. Thus, elevated alpha-plus-beta measurements, with a maximum of 1,700 dpm/100 cm<sup>2</sup>, which are also highly isolated, are unlikely to produce an unacceptable dose under current-use conditions.

Moreover, exposure rate measurements at 1-m suggest that potential doses would not exceed the NRC's unrestricted use dose criterion of 25 mrem/yr for an industrial building occupant screening scenario<sup>2</sup> based on 2,300 hours of occupancy, as was considered in the TI (NRC 2016). The dose criterion would not be exceeded even if all of the occupancy is assumed to occur at 1-m from the largest elevated measurement and the smallest observed background value is used in the calculations.

Regarding the exposure rate measurements at 1-m on the fourth floor in Building B, because the areas of elevated exposure rates are highly localized ( $\leq 0.3 \text{ m}^2$ ) rather than uniformly distributed over the entire interior building surface, it is not likely that an average member of the critical group for a residential occupant scenario would spend a significant portion of their occupancy within 1-m of the localized contamination. Further, consideration of the average reported background rather than a value from the lower half of the range also provides assurance that a residential occupant is not likely to exceed 25 mrem/yr.

It is important to note that this building complex has historically been used as an industrial facility, and its current use is as an industrial facility, due to the current zoning of the building (identified through a City of Bristol Real Property Search). As such, assumption of a residential scenario is conservative.

Based on the above considerations, using site-specific information applied to current and reasonably foreseeable future use occupancy scenarios, NRC's unrestricted use criterion in 10 CFR 20.1402 would not be exceeded.

#### 4.0 OBSERVATIONS AND RECOMMENDATIONS

Based on the data collected, the former Sessions Clock Company contains discrete sources of Ra-226, but not in excess of regulatory requirements for unrestricted use. ORAU made the following observations:

- Elevated direct gamma radiation attributed to Ra-226 was identified on the fourth floor of Building B and the third floor of Building D. However, all exposure rate values, including background, are less than NRC's 40  $\mu\text{R/h}$  action level specified in the TI. Elevated alpha plus beta measurements are of relatively low significance and isolated, with an estimated area of less than 100 cm<sup>2</sup> for each location.
- Results from the site visit are generally consistent with those presented in ATSDR 1999.

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<sup>2</sup>The site is currently used for purposes consistent with an industrial use scenario.

- No areas of discrete Ra-226 contamination were identified as a result of the outdoor surveys.
- Using realistic assumptions of reasonably foreseeable future use occupancy scenarios, the NRC's unrestricted use criterion of 25 mrem/yr in 10 CFR 20.1402 would not be exceeded.

Based on the above observations, it is recommended that the NRC not perform a scoping survey. Based on the dose assessment considerations, and observations above, it is concluded that that doses will not exceed 25 millirem per year.

## 5.0 REFERENCES

ATSDR 1999. *Public Health Implications of Radiation Contamination at Former Clock Factories Located in Bristol (Hartford County), New Haven, (New Haven County), Thomaston (Litchfield County), and Waterbury (New Haven County), Connecticut*, prepared by the Connecticut Department of Public Health under Cooperative Agreement with The Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services, January 29. (Agencywide Documents Access and Management System [ADAMS] Accession No. ML17038A052).

DEEP 1998, Data on Former Watch Manufacturers in Connecticut – Noted from the Connecticut Department of Energy and Environmental Protection (formerly Department of Environmental Protection [DEP]) (ADAMS Accession No. ML17038A170).

Harveson 2017. *The Sessions Clock Company*, Bill Harveson, Discover Clocks Webpage: [http://www.discoverclocks.com/sessions\\_clock.html](http://www.discoverclocks.com/sessions_clock.html), Dunnellon, Florida. Accessed March 20, 2017.

NRC 2001. *Residual Radioactive Contamination from Decommissioning – User's Manual* DandD Version 2.1, NUREG/CR-5512, Vol. 2, U.S. Nuclear Regulatory Commission, April.

NRC 2016. *Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources*, Temporary Instruction 2800/043, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Washington, D.C., October. (ADAMS Accession No. ML16035A053).

ORNL 2015. *Historical Non-Military Radium Sites Research Effort Addendum*, "Sessions Clock Company: Site Summary," pp. 119-127, Oak Ridge National Laboratory, Oak Ridge, Tennessee, November 24. (ADAMS Accession No. ML16291A488).

Sciencetech 2003. *Connecticut Radium Sites Verification Survey*, prepared for: Valley Council of Governments, prepared by: SCIENTECH, Inc., New Milford, Connecticut, ML, October. (ADAMS Accession No. ML17039A514).

**APPENDIX A  
PHOTOS FROM THE SESSIONS SITE VISIT**

Select Photos from the Sessions Site Visit



**A-1. Highest Gamma Response Located on the Fourth Floor of Building B (photo looking approximately east)**



**A-2. Area of Contamination Identified on the Third Floor of Building D (photo looking approximately southwest)**



Select Photos from the Sessions Site Visit



**A-3. Manufacturing Area in Building X**



**A-4. Access Limitations in Building W**



**A-5. Access Limitations in Building X**



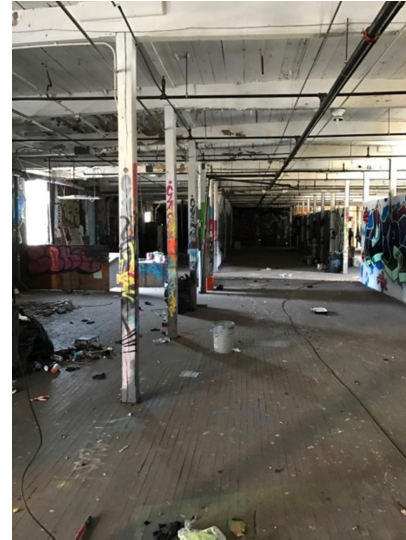
**A-6. Manufacturing Area in Building W**



Select Photos from the Sessions Site Visit



**A-7. Access Limitations in Building A**



**A-8. Building V**



**A-9. Bridge Between Building A and W**

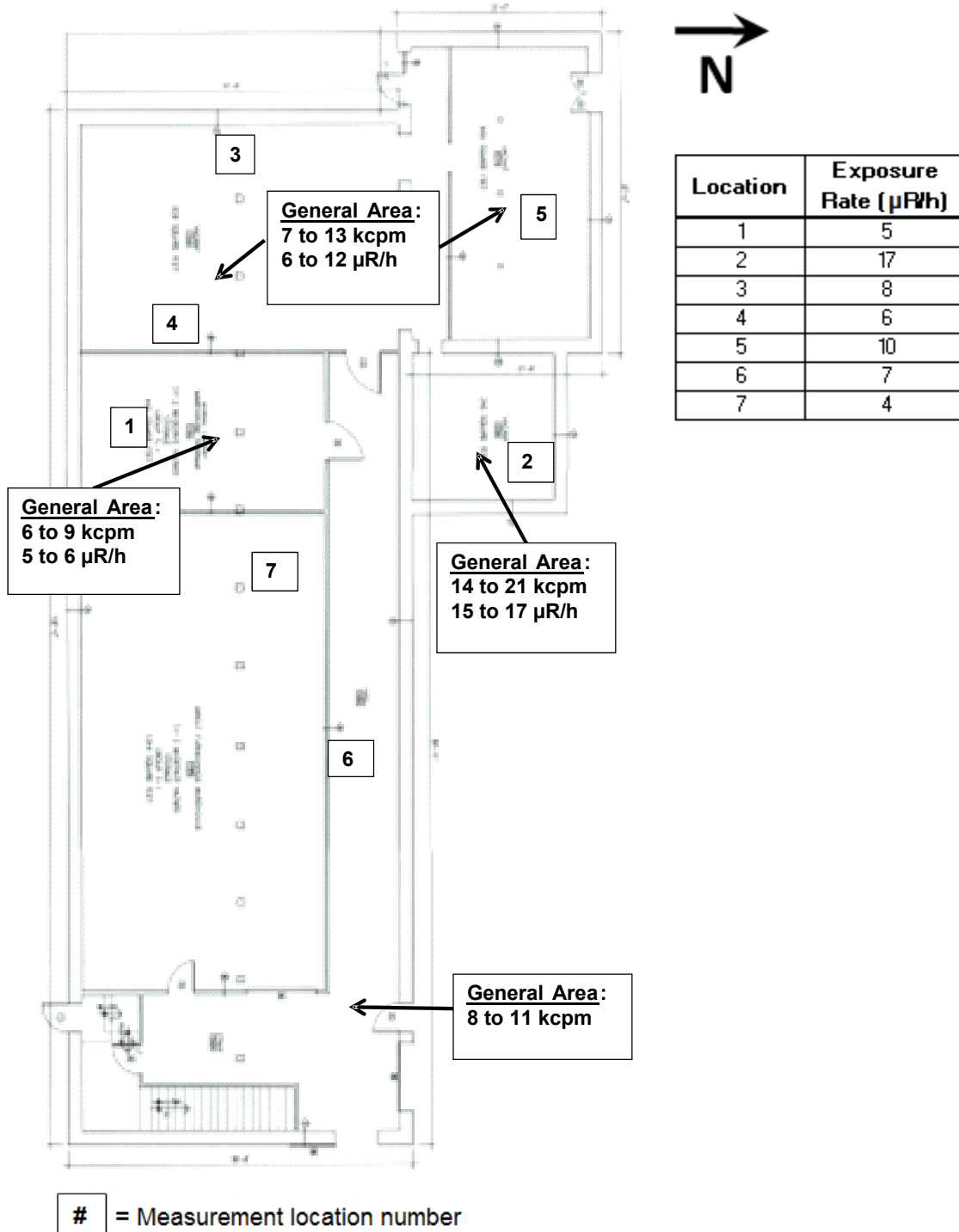


**A-10. Access Limitations North of Building X and W**

**APPENDIX B  
SURVEY MAPS AND DATA TABLES**

<b>Site:</b> Sessions	<b>Area:</b> Bldg A - 1st Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 14:30
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	6 to 21 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1129	NA	4 to 17 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.

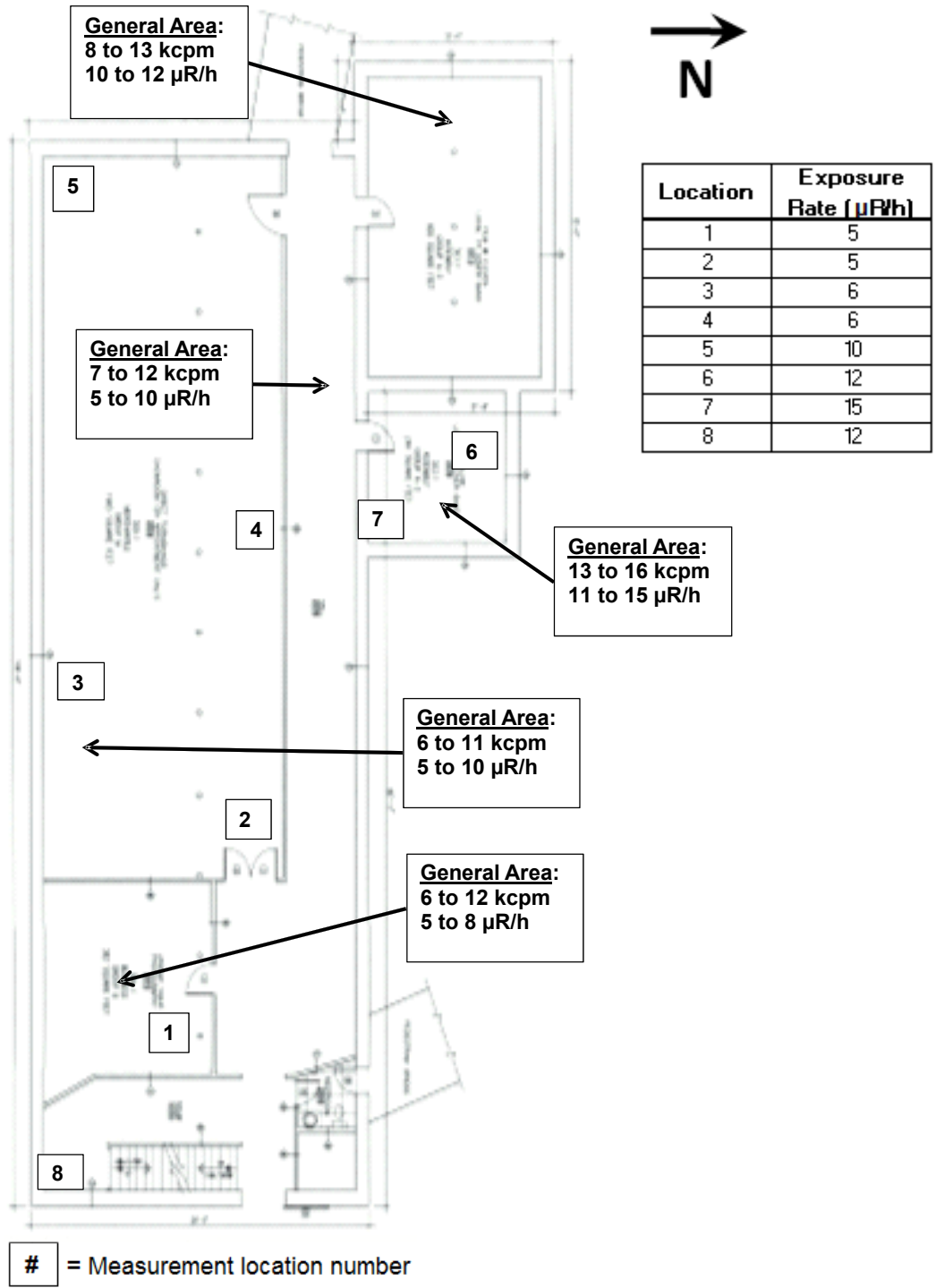




<b>Site:</b> Sessions	<b>Area:</b> Building A 2nd Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 11:50
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	6 to 16 kcpm*
Exposure Rate (gamma)	192 No. 1129	NA	5 to 12 $\mu$ R/h*

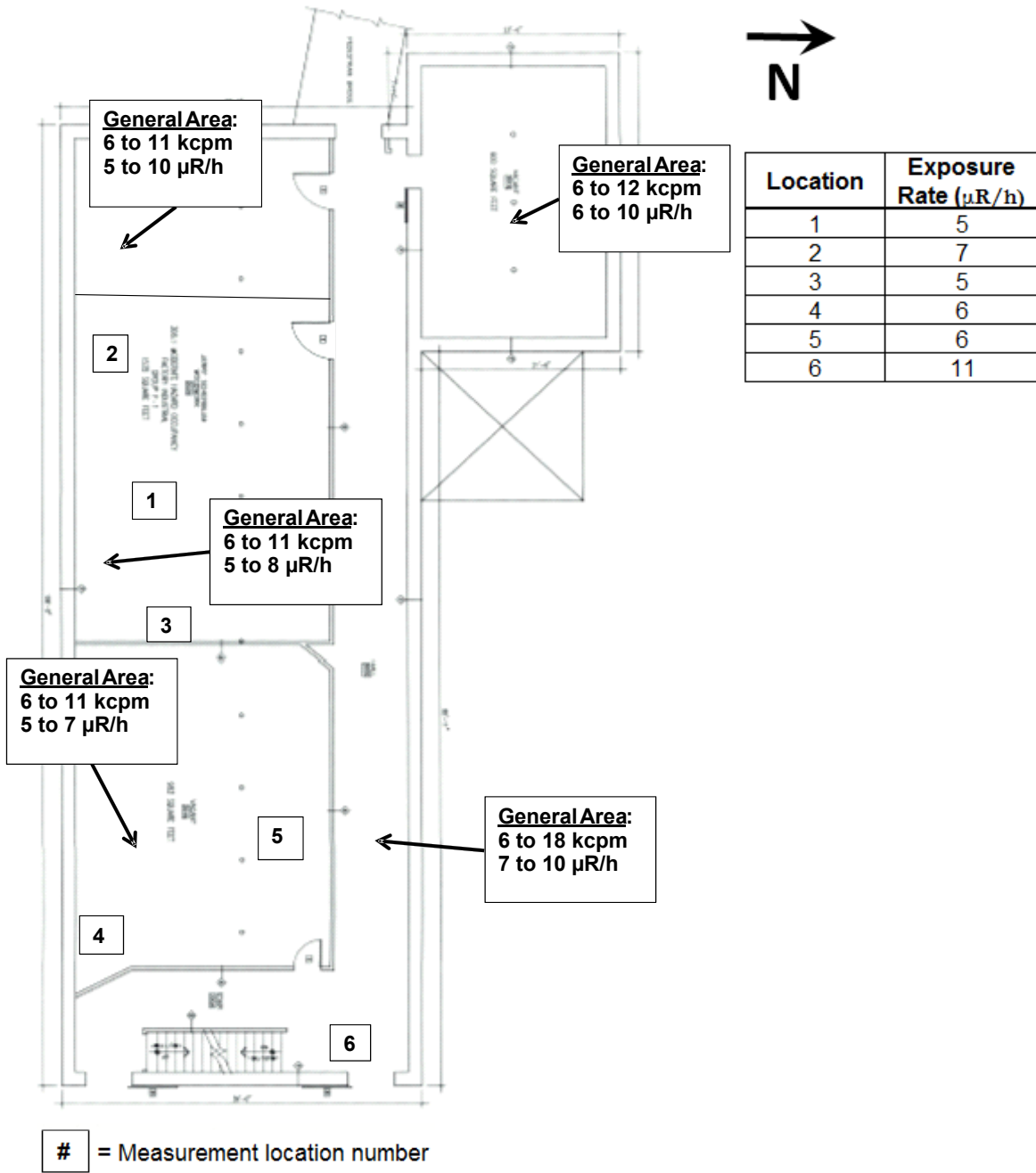
\*Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Building A 3rd Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 9:35
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	6 to 18 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1129	NA	5 to 10 μR/h <sup>a</sup>

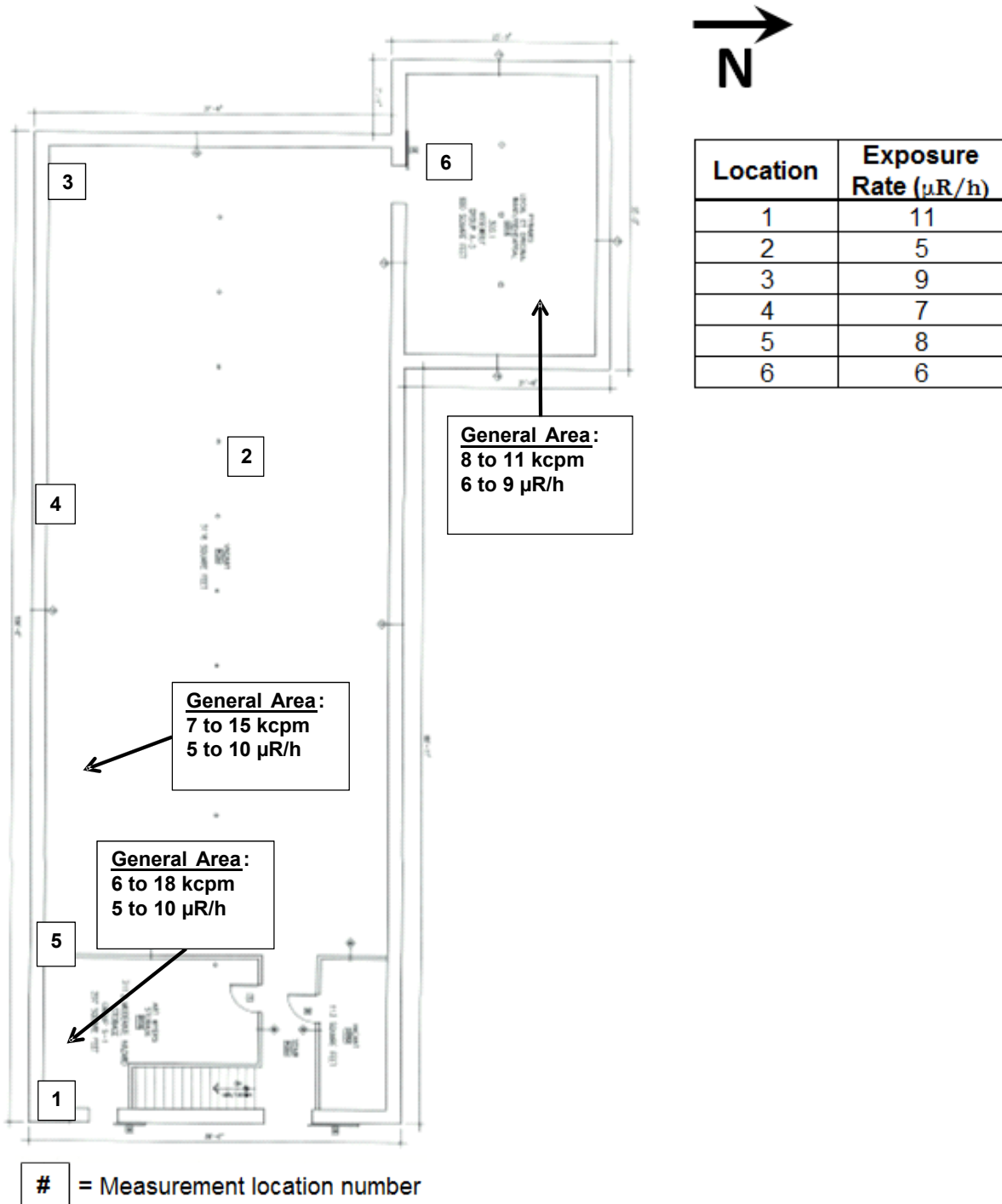
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Building A 4th Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 10:10
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

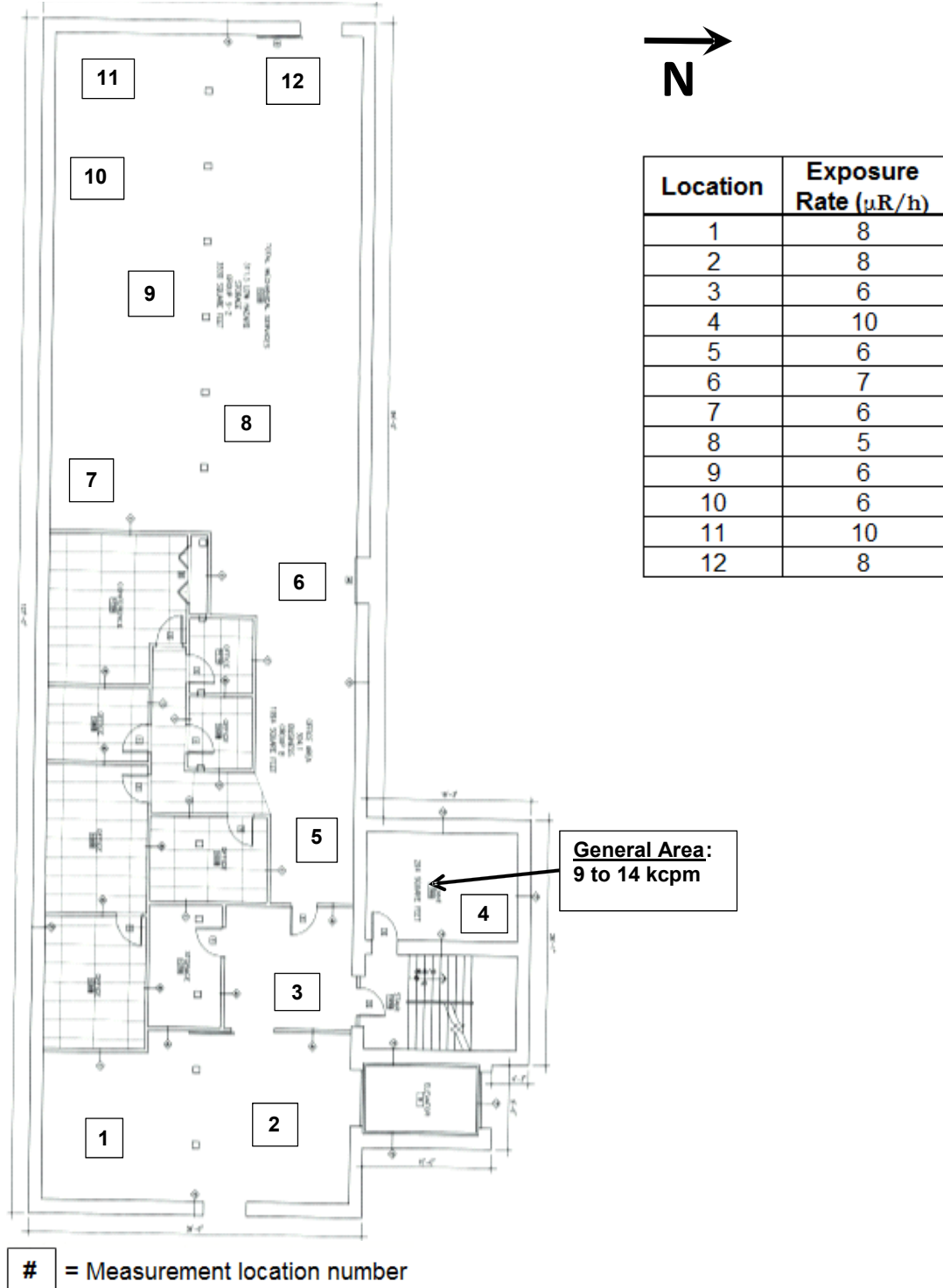
Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	6 to 18 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1129	NA	5 to 10 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



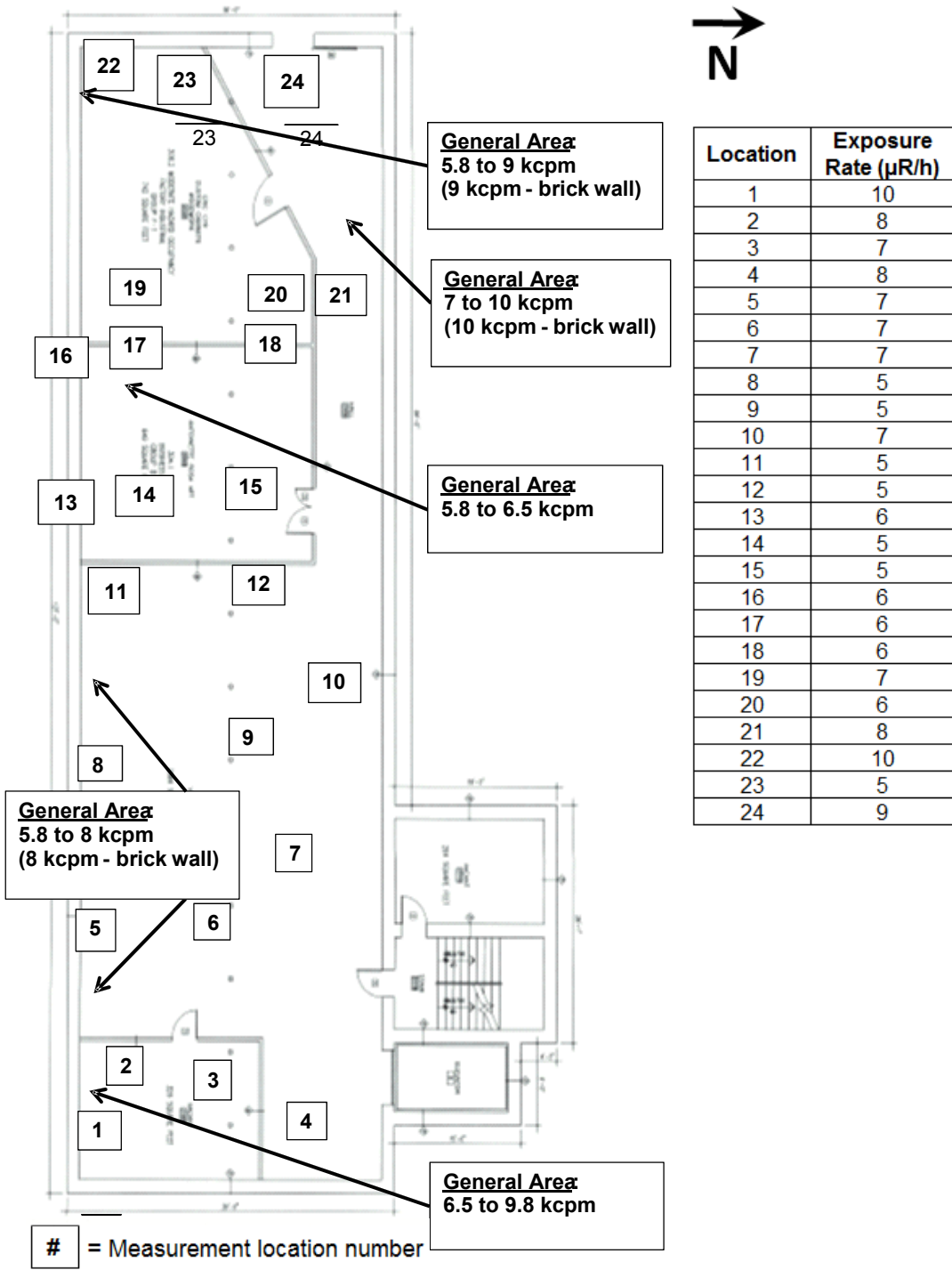
<b>Site:</b> Sessions	<b>Area:</b> Building B - 1st Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 10:35
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	7 to 13 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127	NA	7 to 10 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



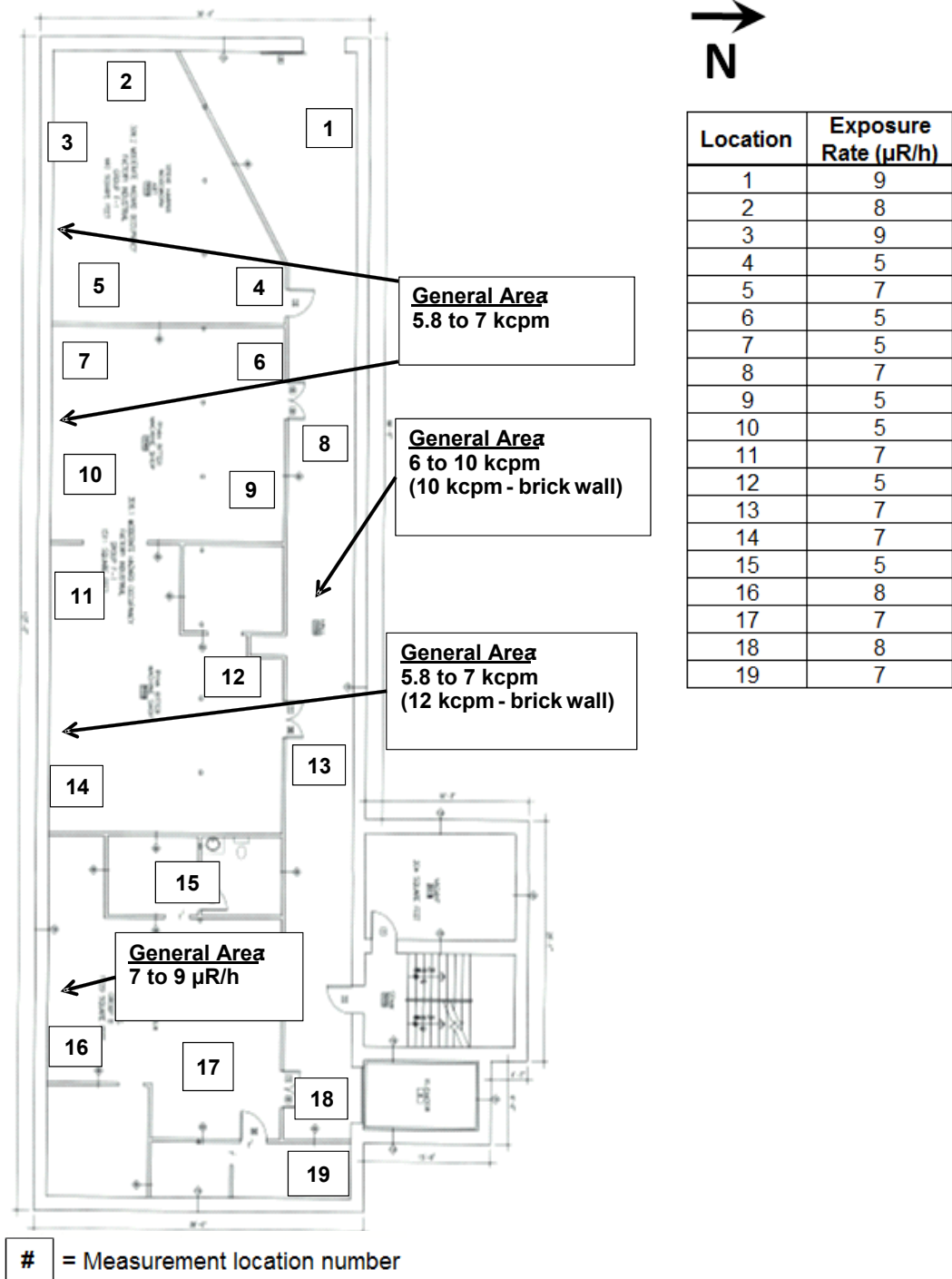
<b>Site:</b> Sessions	<b>Area:</b> Bldg B - 2nd Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 8:00
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 1143	44-10 No. 114	5.8 10 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1129	NA	5 10 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg B - 3rd Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 9:30
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 1143	44-10 No. 664	5.8 to 10 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No.	NA	5 to 9 $\mu$ R/h <sup>a</sup>

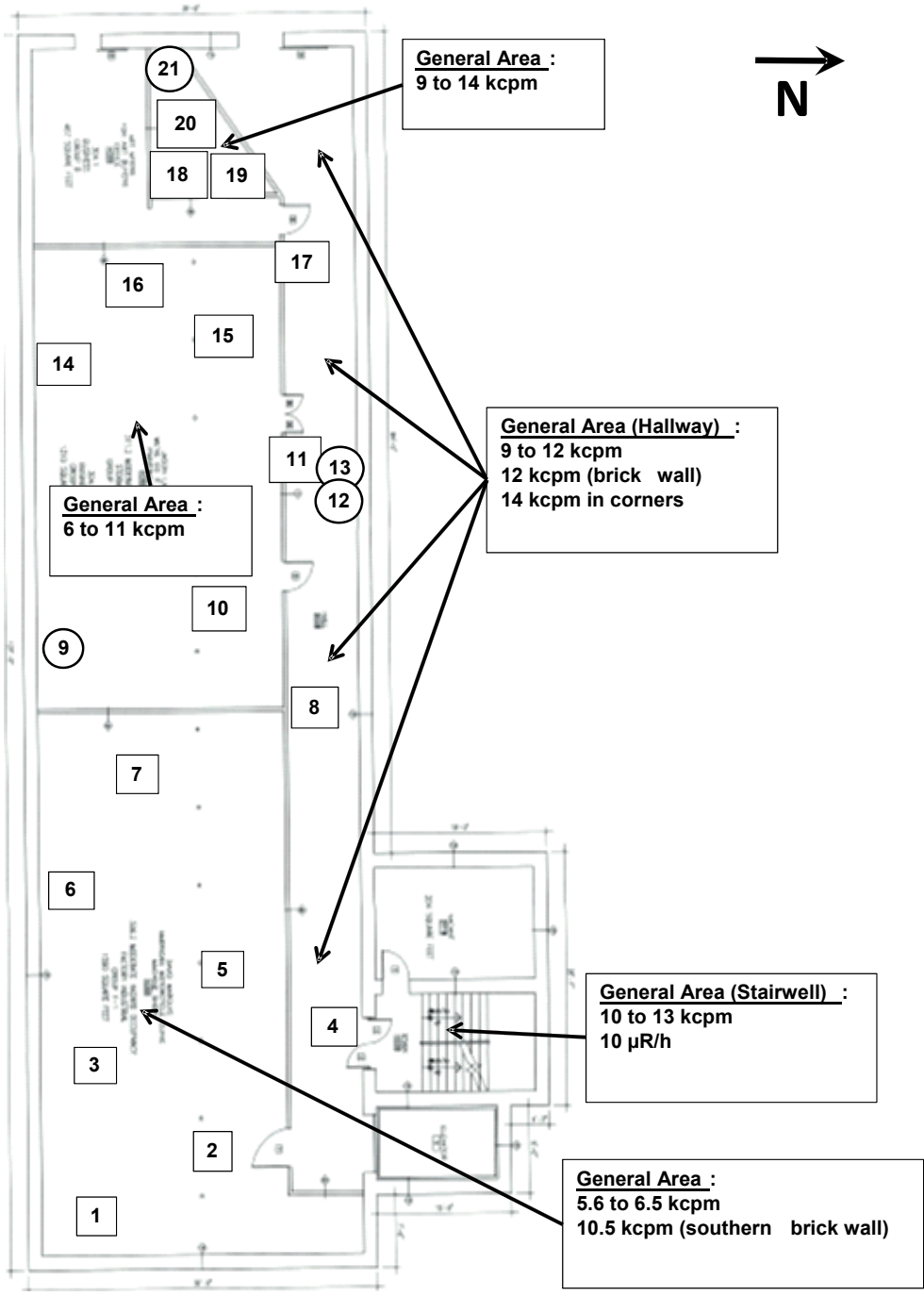
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg B - 4th Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 8:00
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Alpha-plus-beta	2221 No. 1143	44-142 No. 920	380 cpm
Gamma	2221 No. 1143	44-10 No. 664	9 to 13 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 920	NA	5 to 15 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



- # = smear location
- # = Measurement location number

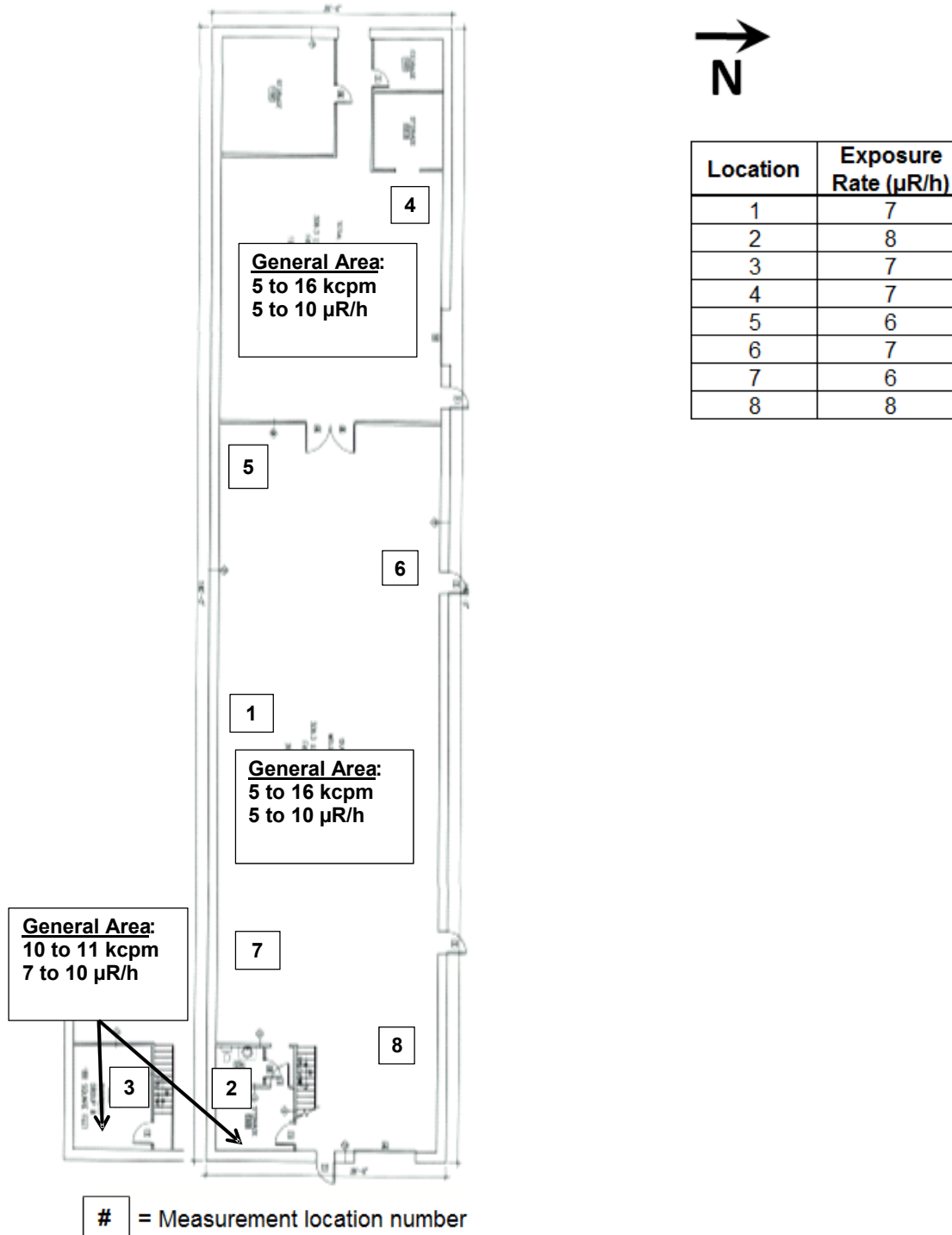
See attached table for measurement results

Sessions Measurement & Smear Results - Building B, 4th Floor									
Location No.	Removable <sup>a</sup>			Alpha-plus-Beta <sup>b</sup>		Gamma <sup>c</sup>			Comments
	Smear No.	(dpm/100 cm <sup>2</sup> )		Gross	Total	Contact		1 m	
		Alpha	Beta	cpm	dpm/100 cm <sup>2</sup>	cpm	?R/hr	?R/hr	
1	—	—	—	—	—	—	—	6	
2	—	—	—	—	—	—	—	6	
3	—	—	—	—	—	—	—	7	
4	—	—	—	—	—	—	—	9	
5	—	—	—	—	—	—	—	5	
6	—	—	—	—	—	—	—	6	
7	—	—	—	—	—	—	—	5	
8	—	—	—	—	—	—	—	8	
9	R0061	2	0	1072	430	21,000	20	10	Discrete Hotspot <sup>d</sup>
10	—	—	—	—	—	—	—	5	
11	—	—	—	—	—	—	—	9	
12	R0063	0	0	3,023	1,700	21,000	20	—	Discrete Hotspot <sup>d</sup>
13	R0062	0	3	1874	930	31,000	35	15	Discrete Hotspot <sup>d</sup>
14	—	—	—	—	—	—	—	6	
15	—	—	—	—	—	—	—	5	
16	—	—	—	—	—	—	—	7	
17	—	—	—	—	—	—	—	9	
18	—	—	—	—	—	—	—	9	
19	—	—	—	—	—	—	—	7	
20	—	—	—	—	—	—	—	10	
21	R0060	2	3	943	350	20,000	18	12	Discrete Hotspot <sup>d</sup>
a) As reported by the Radiochemistry and Environmental Analytical Laboratory in Oak Ridge, Tennessee									
b) Ludlum 44-142 plastic scintillator with Ludlum 2221 rate meter									
c) Ludlum 44-10 NaI with Ludlum 2221 rate meter; Ludlum 192 NaI									
d) On average, hotspots ? 0.3 m <sup>2</sup> .									
— indicates measurement not collected at this location									



<b>Site:</b> Sessions	<b>Area:</b> Building C - 1st Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 9:50
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	5 to 16 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127	NA	5 to 10 $\mu$ R/h <sup>a</sup>

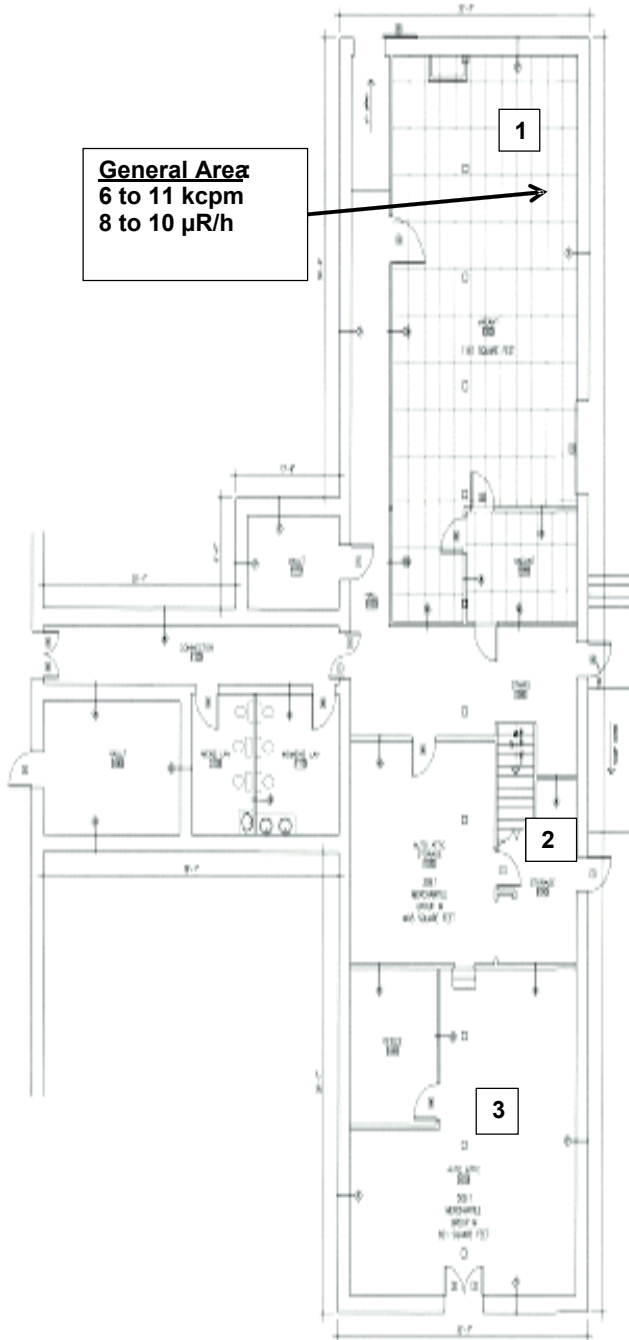
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg D - 1st Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 15:35
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	6 to 14 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	8 to 13 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.

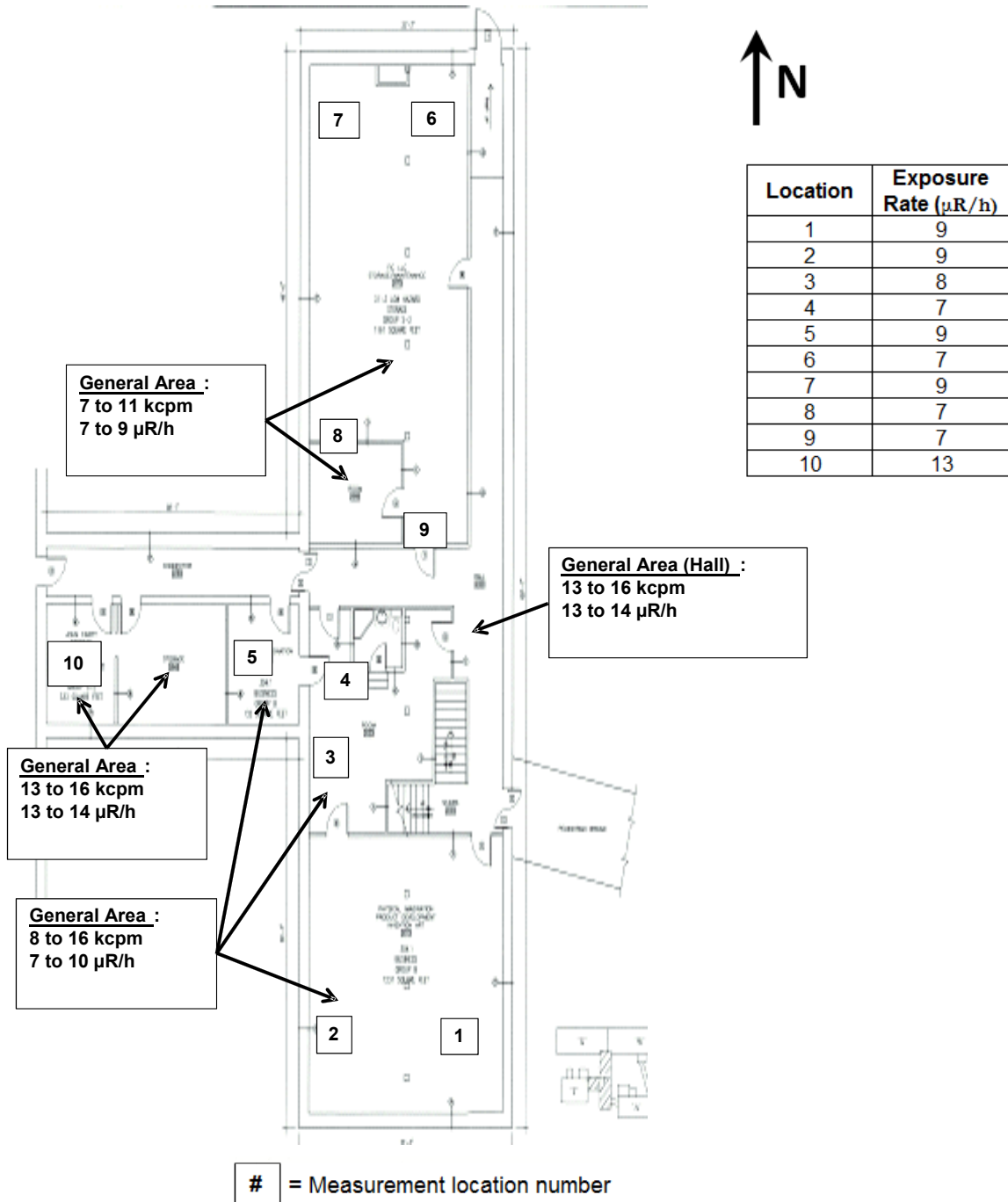


Location	Exposure Rate ( $\mu$ R/h)
1	8
2	13
3	10

# = Measurement location number

<b>Site:</b> Sessions	<b>Area:</b> Bldg D - 2nd Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 15:30
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	7 to 16 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	7 to 14 $\mu$ R/h <sup>a</sup>

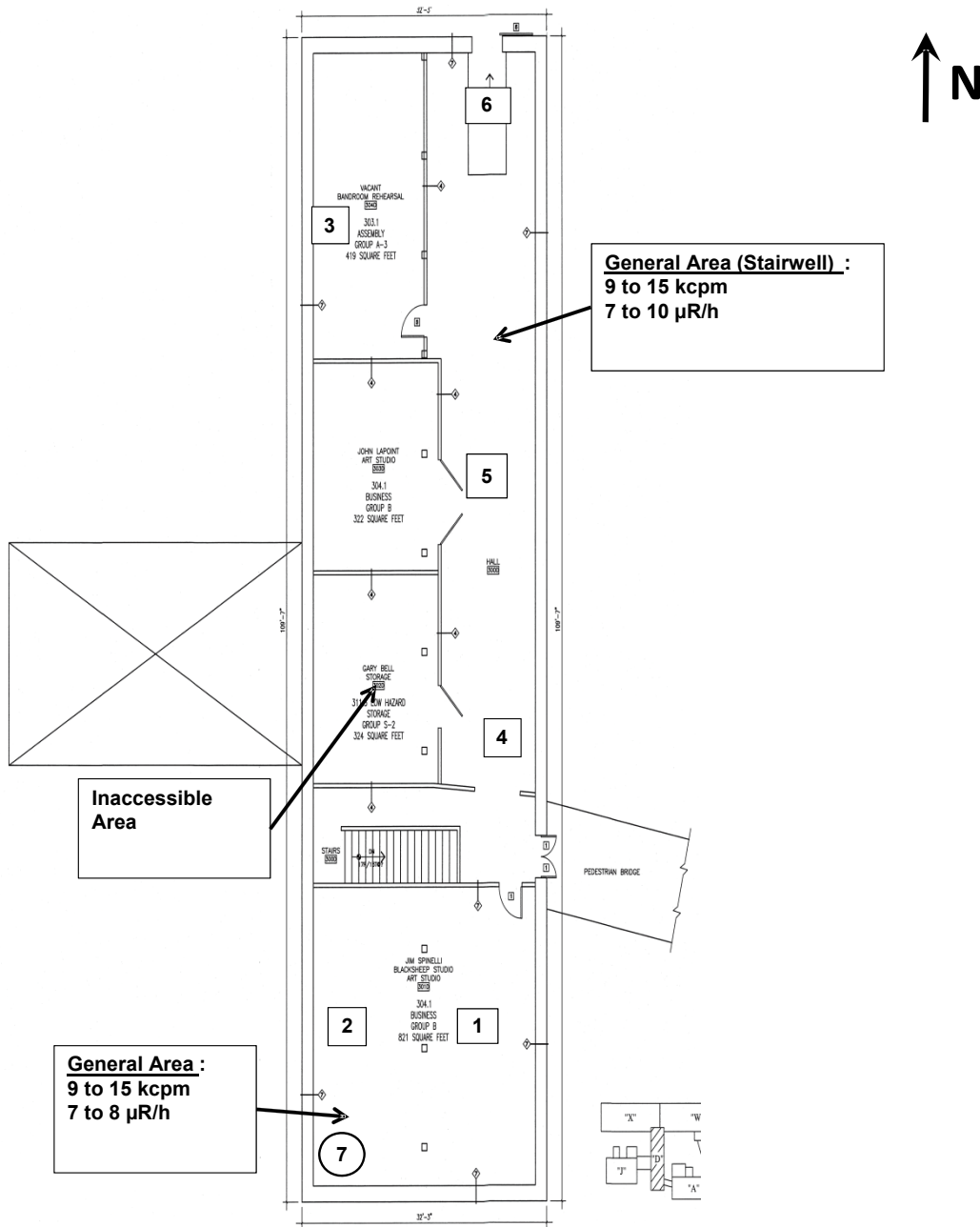
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg D - 3rd Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 14:05
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Alpha-plus-beta	2221 No. 1143	44-142 920	380 cpm
Gamma	2221 No. 590	44-10 No. 908	9 to 15 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	8 to 13 μR/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



# = smear location

# = Measurement location number

See attached table for measurement results

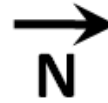
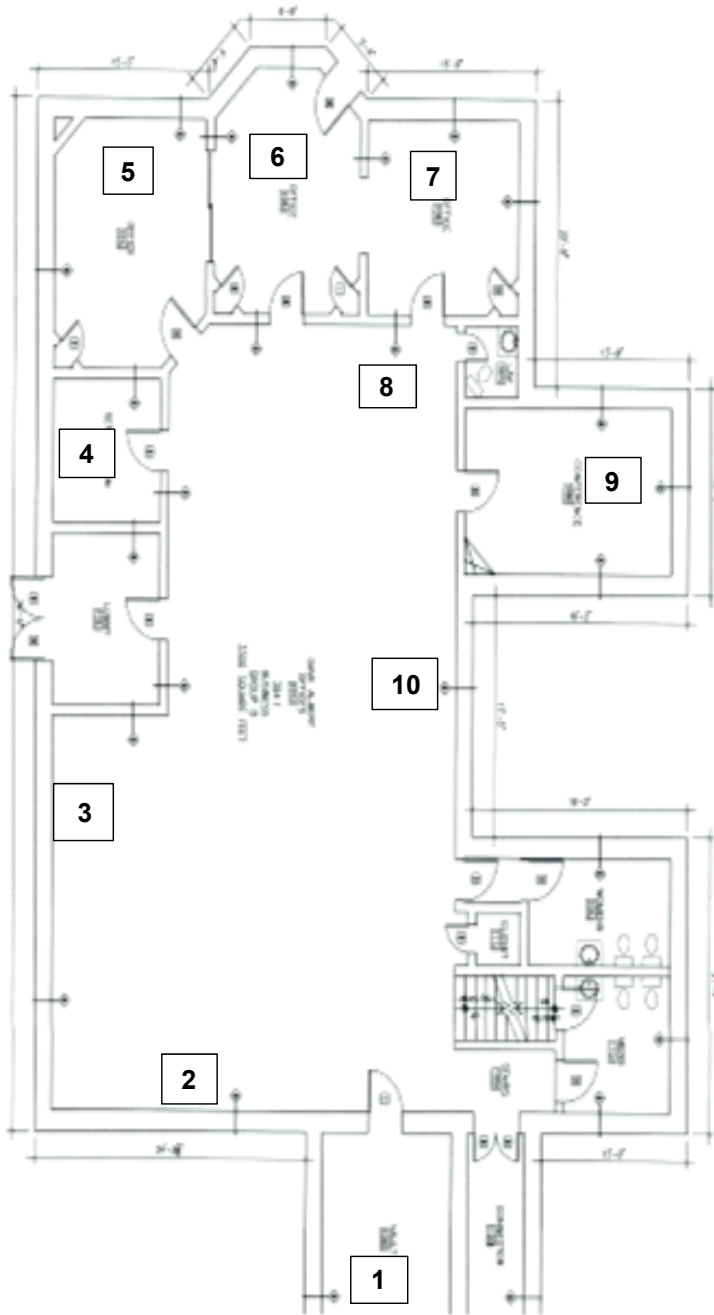
**Sessions Measurement & Smear Results - Building D, 3rd Floor**

Location No.	Removable <sup>a</sup>		Alpha-plus-Beta <sup>b</sup>		Gamma <sup>c</sup>			Comments	
	Smear No.	(dpm/100 cm <sup>2</sup> )		Gross	Total	Contact			1 m
		Alpha	Beta	cpm	dpm/100 cm <sup>2</sup>	cpm	?R/hr		?R/hr
1	—	—	—	—	—	—	—	9	
2	—	—	—	—	—	—	—	9	
3	—	—	—	—	—	—	—	8	
4	—	—	—	—	—	—	—	8	
5	—	—	—	—	—	—	—	8	
6	—	—	—	—	—	—	—	10	
7	R0064	0	-1	1,005	390	23,000	20	11	Discrete hotspot <sup>d</sup>
a) As reported by the Radiochemistry and Environmental Analytical Laboratory in Oak Ridge, Tennessee									
b) Ludlum 44-142 plastic scintillator with Ludlum 2221 rate meter									
c) Ludlum 44-10 NaI with Ludlum 2221 rate meter; Ludlum 192 NaI									
d) On average, hotspots ? 0.3 m <sup>2</sup> .									
— indicates measurement not collected at this location									

<b>Site:</b> Sessions	<b>Area:</b> Bldg J - 1st Floor	<b>Date(s):</b> 12/20/2016	<b>Time:</b> 16:15
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	8 to 13 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127	NA	9 to 13 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



Location	Exposure Rate ( $\mu$ R/h)
1	13
2	9
3	9
4	9
5	9
6	10
7	10
8	10
9	11
10	10

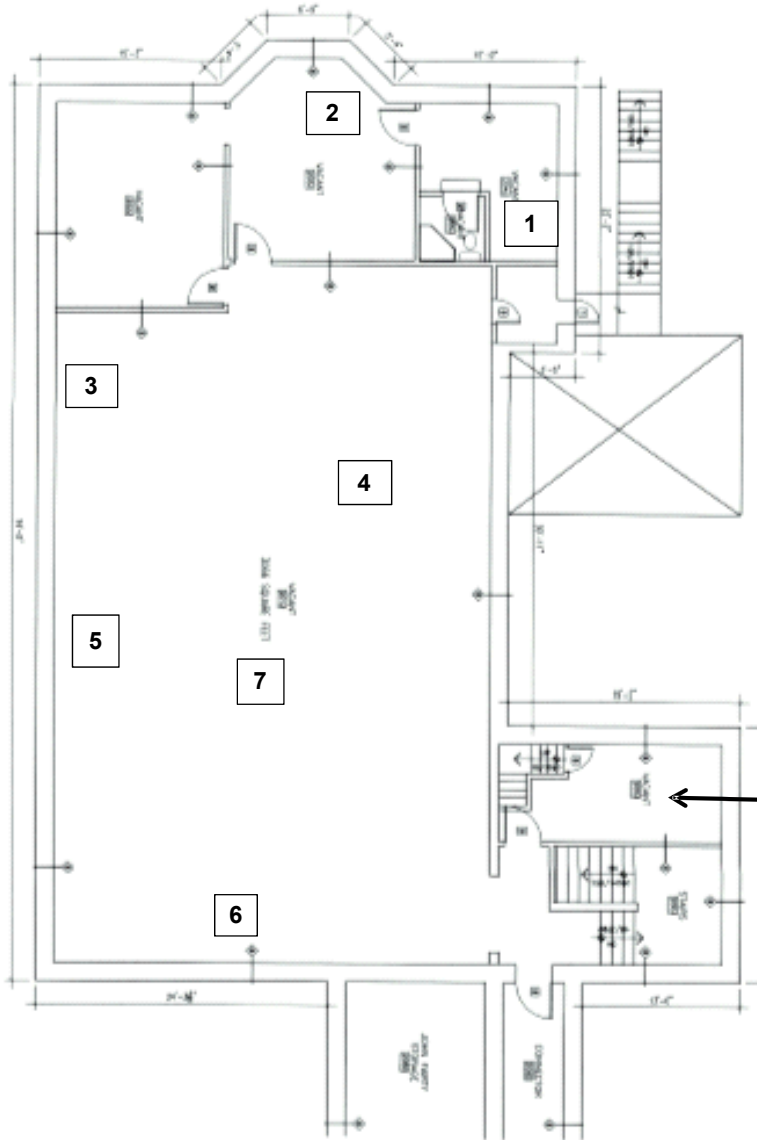
**General in All Areas**  
8 to 13 kcpm

# = Measurement location number

<b>Site:</b> Sessions	<b>Area:</b> Bldg J - 2nd Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 13:55
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	8 to 14 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127	NA	8 to 12 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



Location	Exposure Rate ( $\mu$ R/h)
1	8
2	8
3	8
4	9
5	9
6	12
7	9

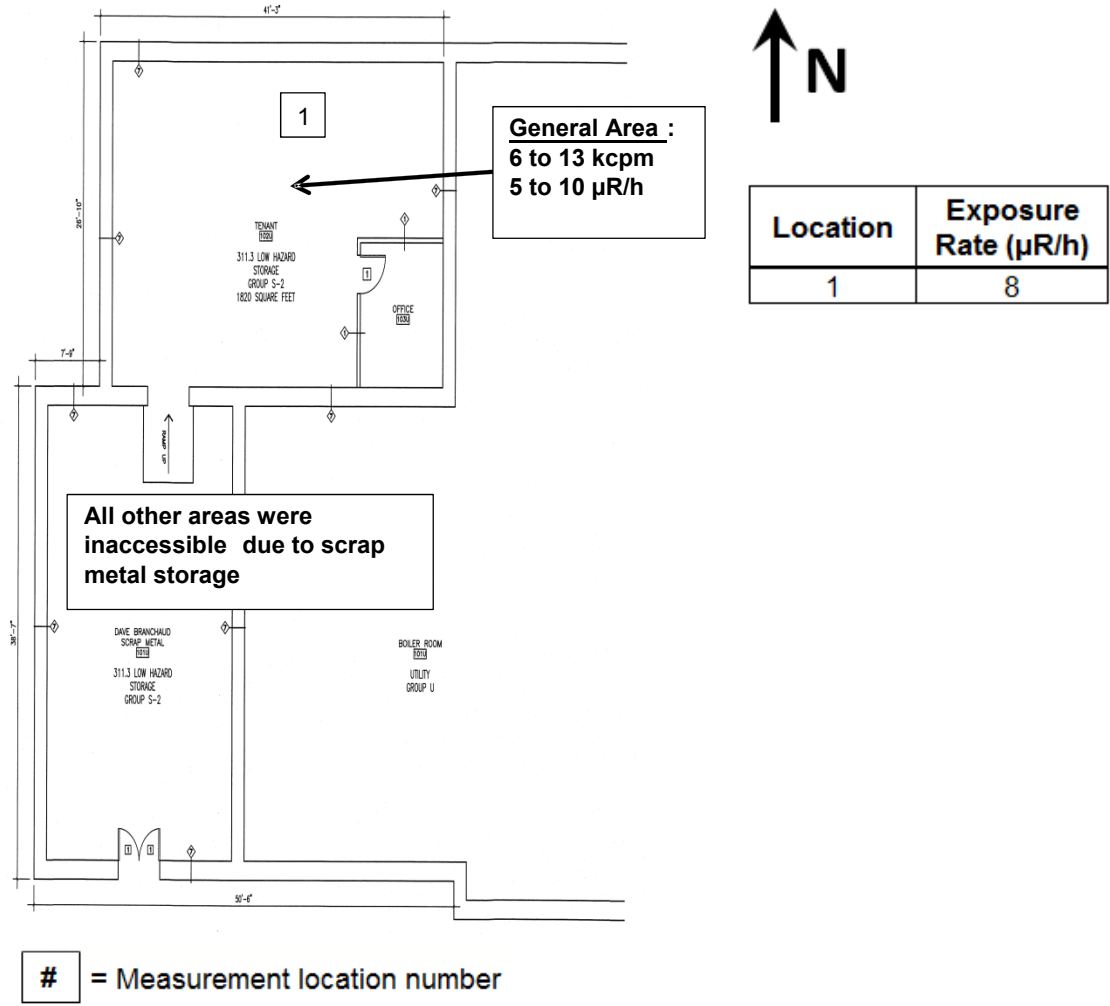
**General Area:**  
13 to 14 kcpm  
10 to 12  $\mu$ R/h

# = Measurement location number

<b>Site:</b> Sessions	<b>Area:</b> Bldg U - 1st Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 16:35
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	6 to 13 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	5 to 10 μR/h <sup>a</sup>

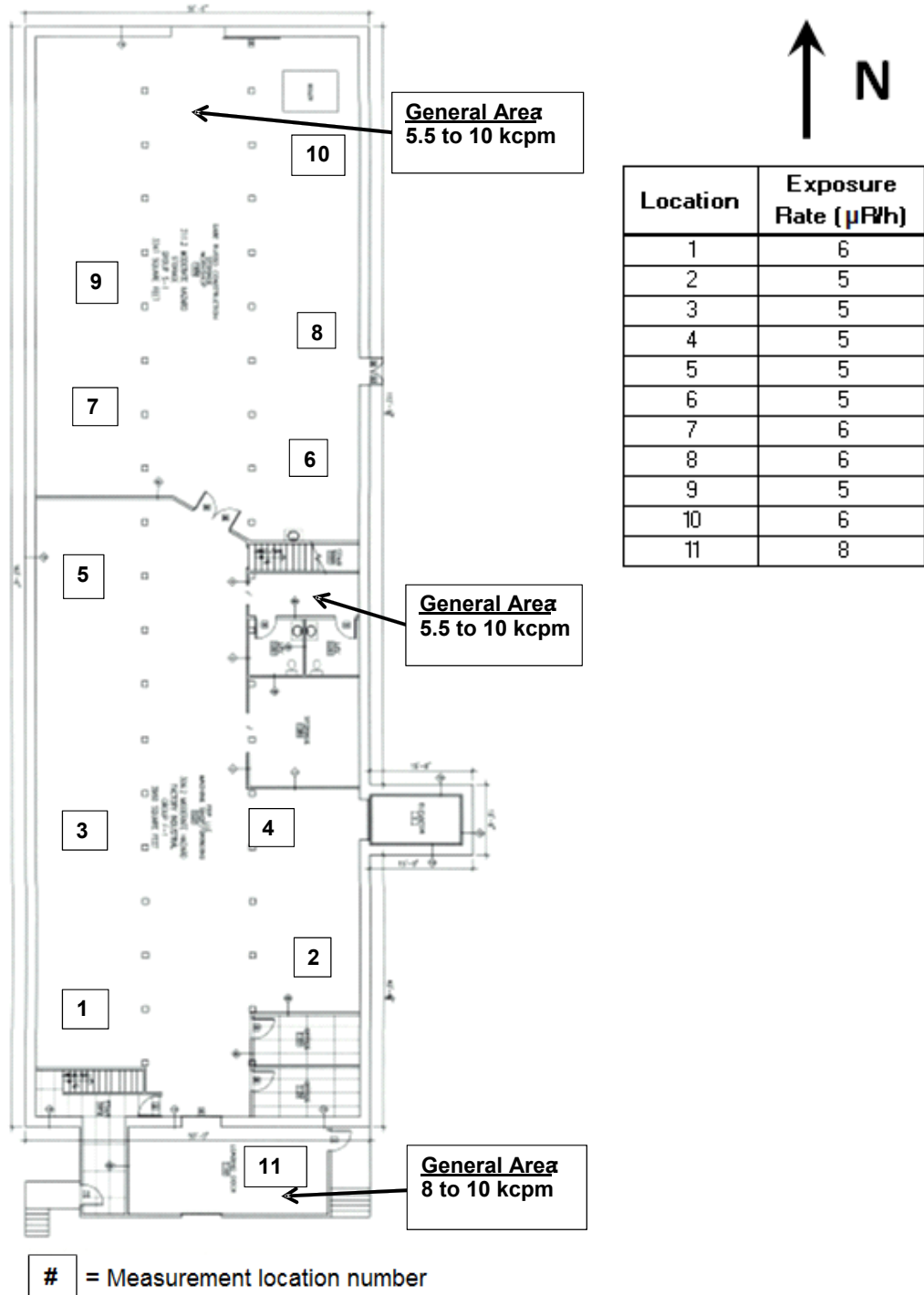
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.





<b>Site:</b> Sessions	<b>Area:</b> Bldg V - 1st Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 9:00
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 664	44-10 No. 1143	5.5 to 10 kcpm*
Exposure Rate (gamma)	192 No. 1129	NA	5 to 6 $\mu$ R/h*

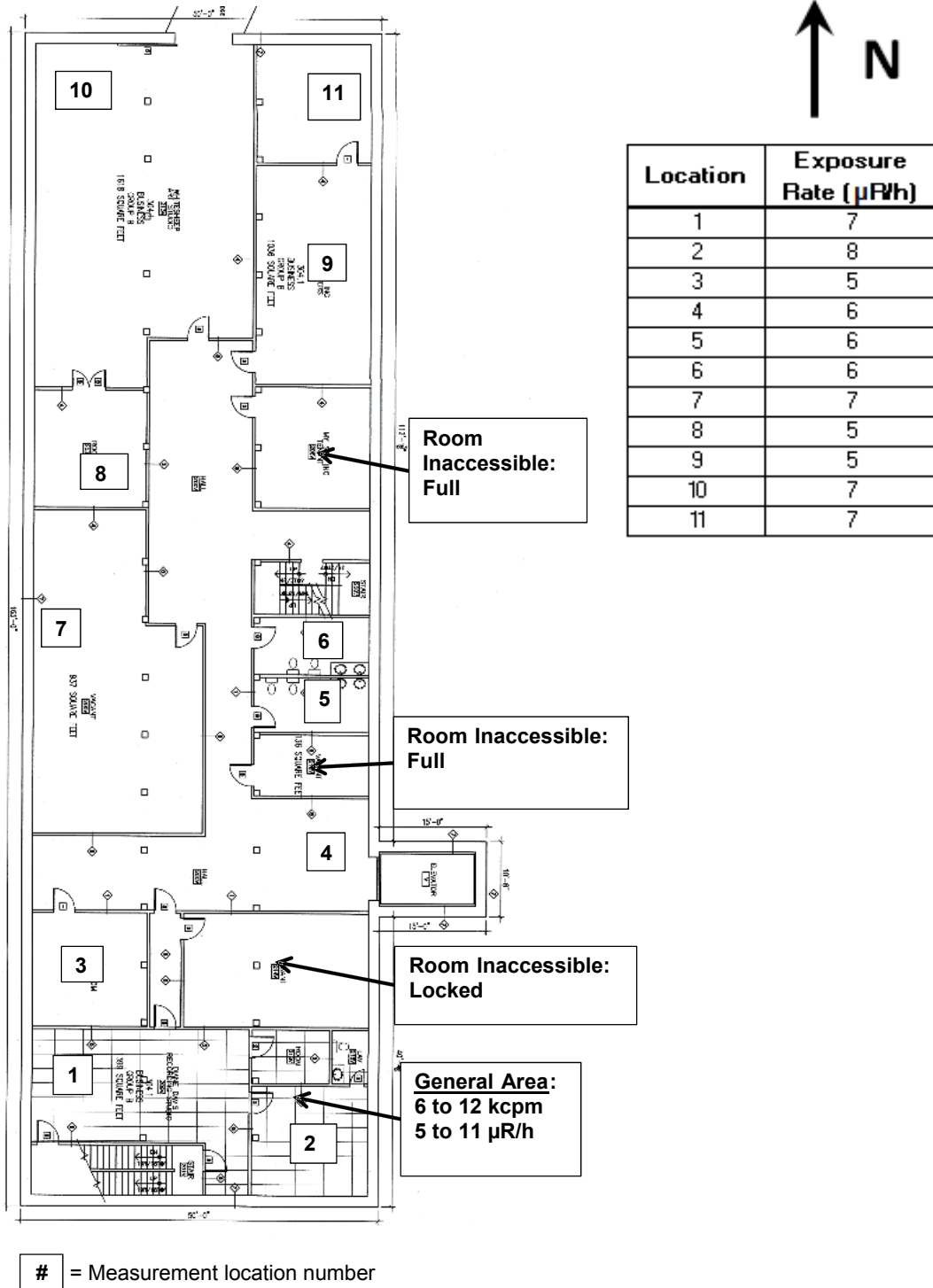
\*Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg V - 2nd Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 11:23
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 664	44-10 No. 1143	5.5 to 12 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1129	NA	5 to 8 $\mu$ R/h <sup>a</sup>

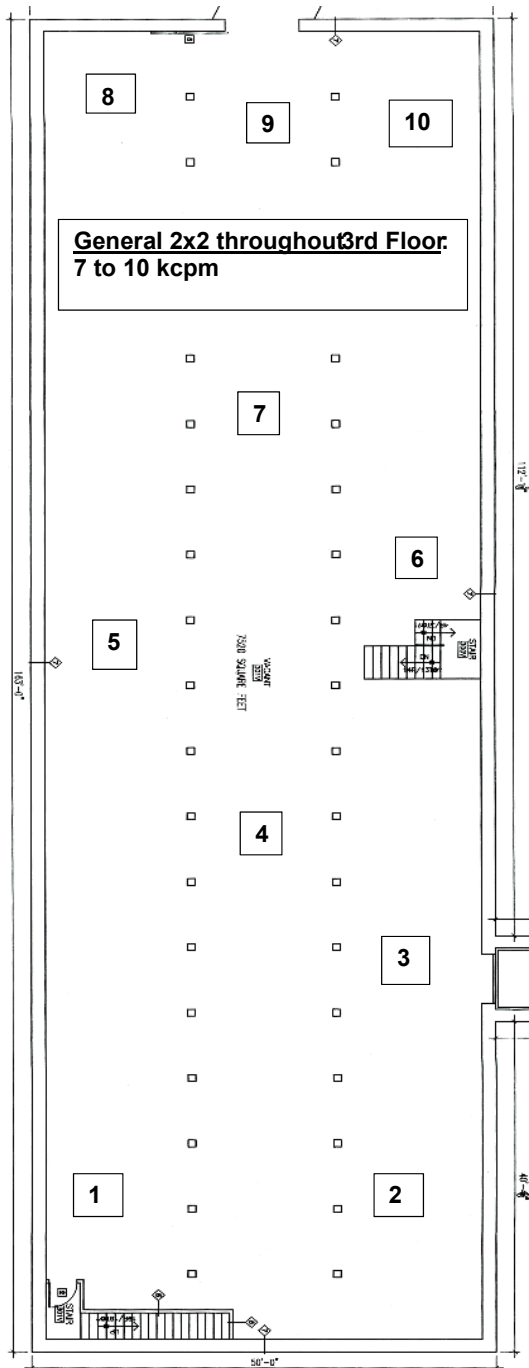
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg V - 3rd Floor	<b>Date(s):</b> 12/21/2016	<b>Time:</b> 11:00
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 664	44-10 No. 1143	7 to 10 kcpm*
Exposure Rate (gamma)	192 No. 1129	NA	5 to 8 $\mu$ R/h*

\*Background varied depending on naturally occurring radioactive material in the area.

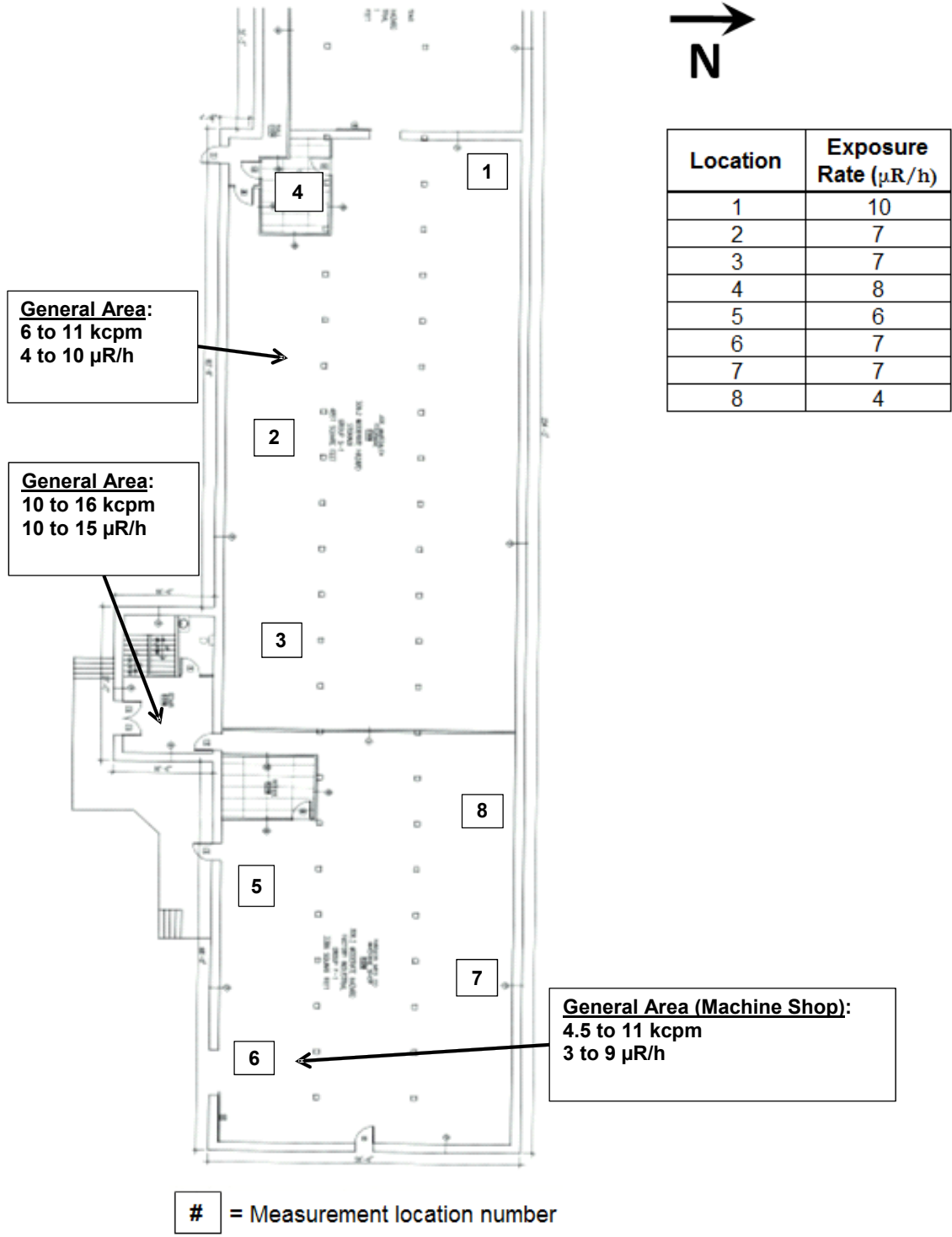


Location	Exposure Rate ( $\mu$ R/h)
1	7
2	7
3	6
4	5
5	6
6	5
7	5
8	8
9	7
10	8

# = Measurement location number  
#

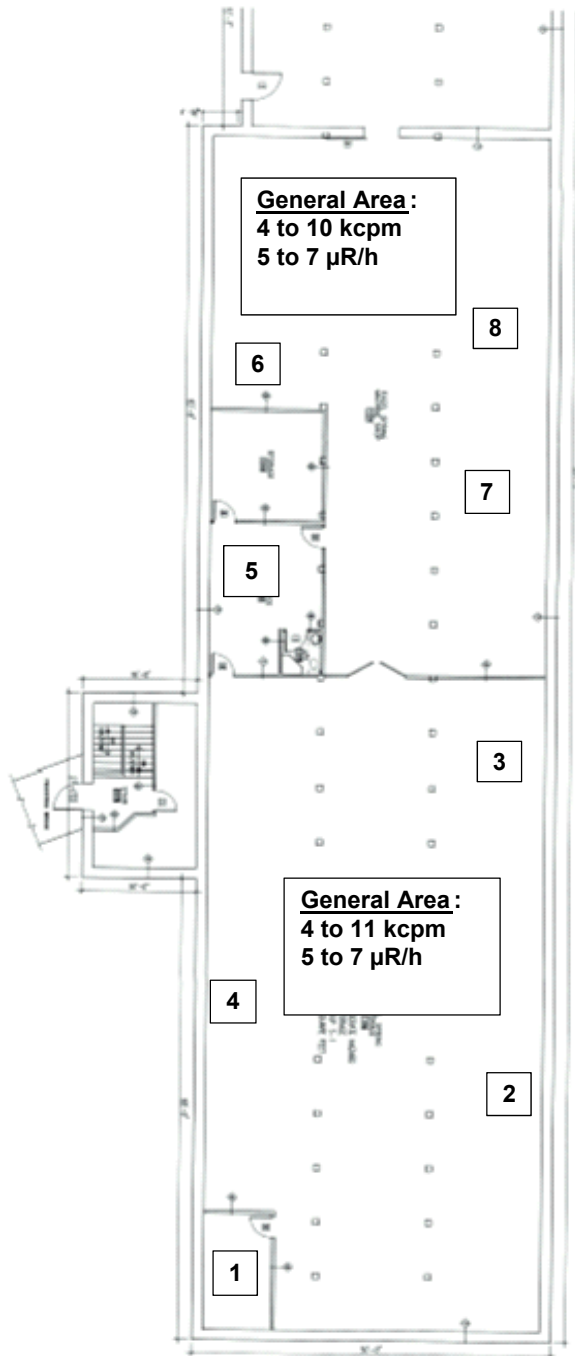
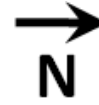
<b>Site:</b> Sessions	<b>Area:</b> Bldg W - 1st Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 16:00
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	4.5 to 16 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	3 to 15 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Bldg W - 2nd Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 14:40
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	4 to 11 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	5 to 7 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



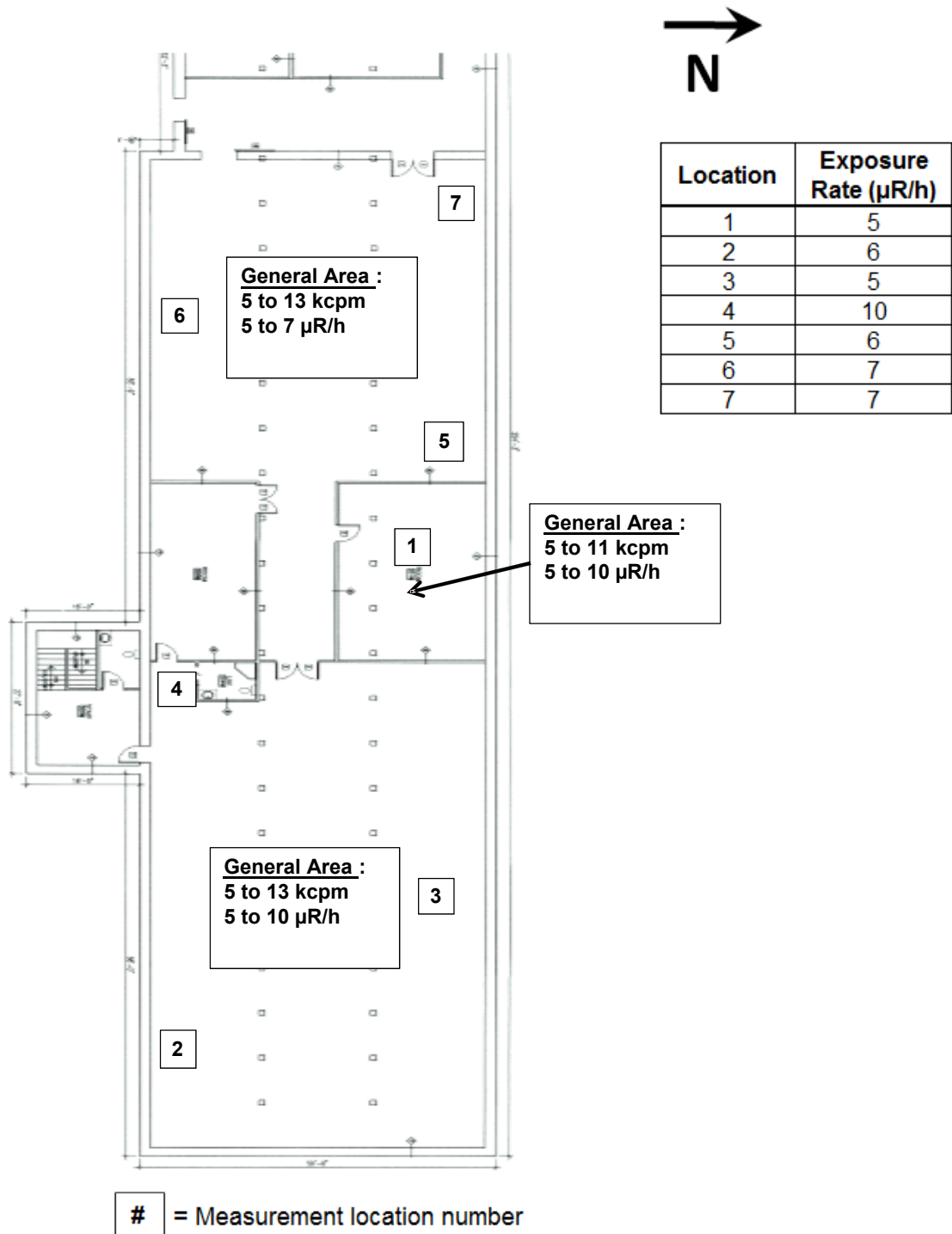
Location	Exposure Rate ( $\mu$ R/h)
1	7
2	5
3	4
4	5
5	7
6	5
7	5
8	6

# = Measurement location number

<b>Site:</b> Sessions	<b>Area:</b> Bldg W - 3rd Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 13:20
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	

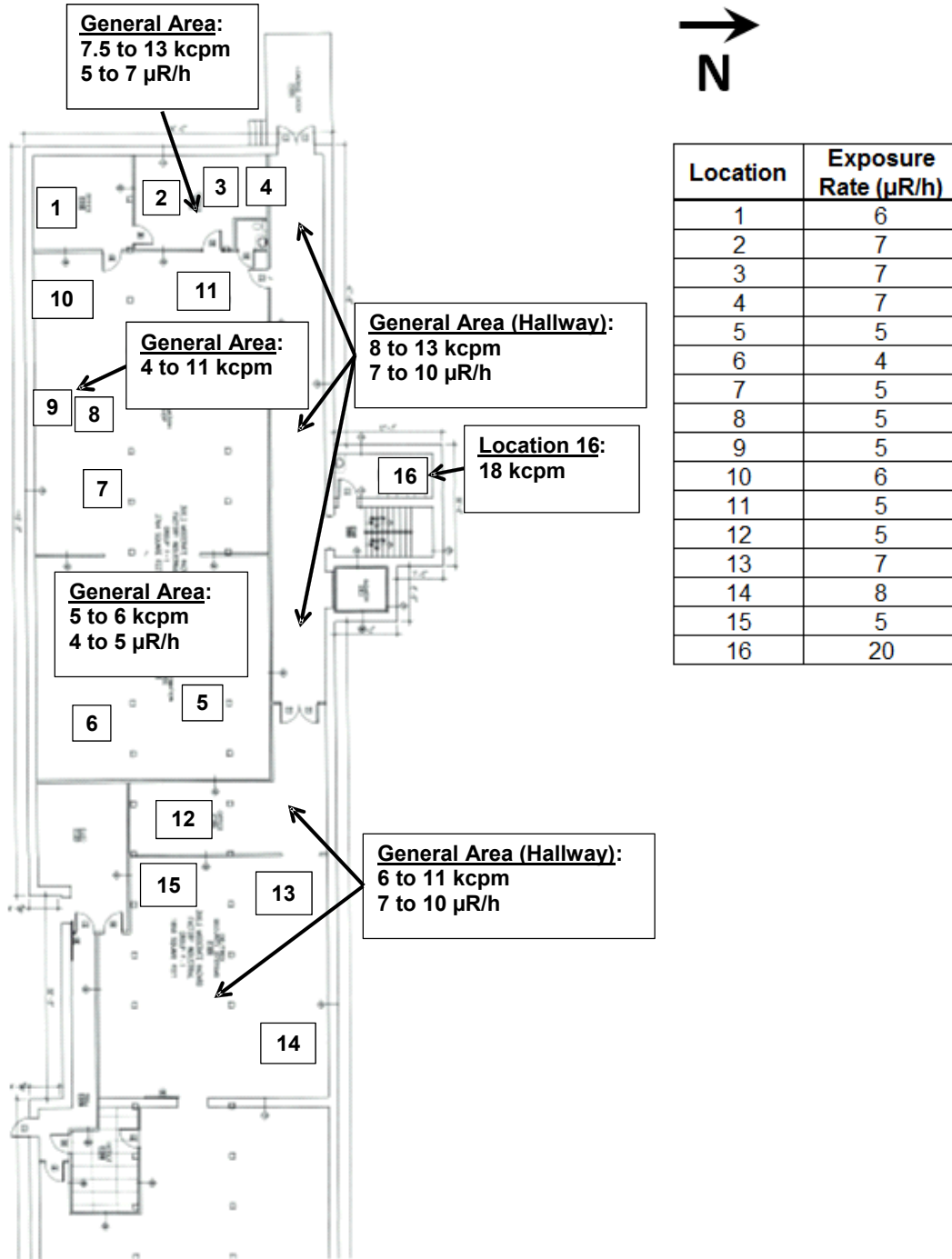
Radiation Type	Instrument	Detector	Background
Gamma	2221 No. 590	44-10 No. 908	5 to 13 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	5 to 10 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Building X - 1st Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 9:30
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	5 to 18 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	4 to 20 $\mu$ R/h <sup>a</sup>

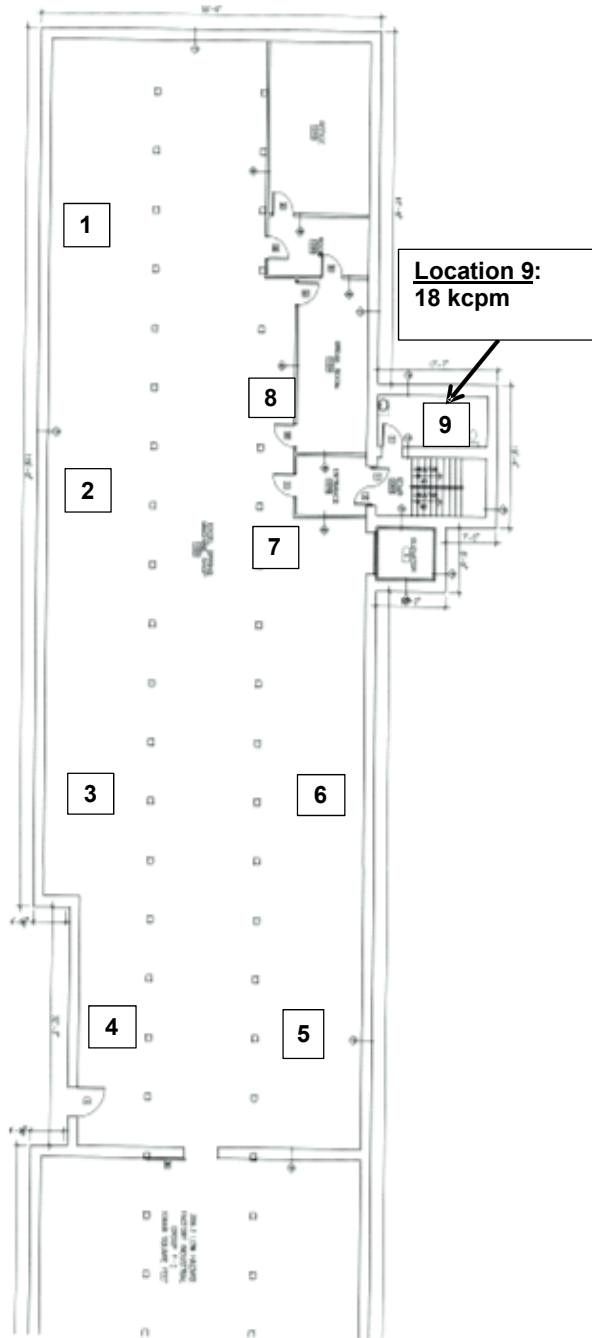
<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



# = Measurement location number

<b>Site:</b> Sessions	<b>Area:</b> Building X - 2nd Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 10:40
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	5 to 18 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	4 to 20 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



Location	Exposure Rate ( $\mu$ R/h)
1	6
2	5
3	8
4	9
5	6
6	5
7	5
8	5
9	20

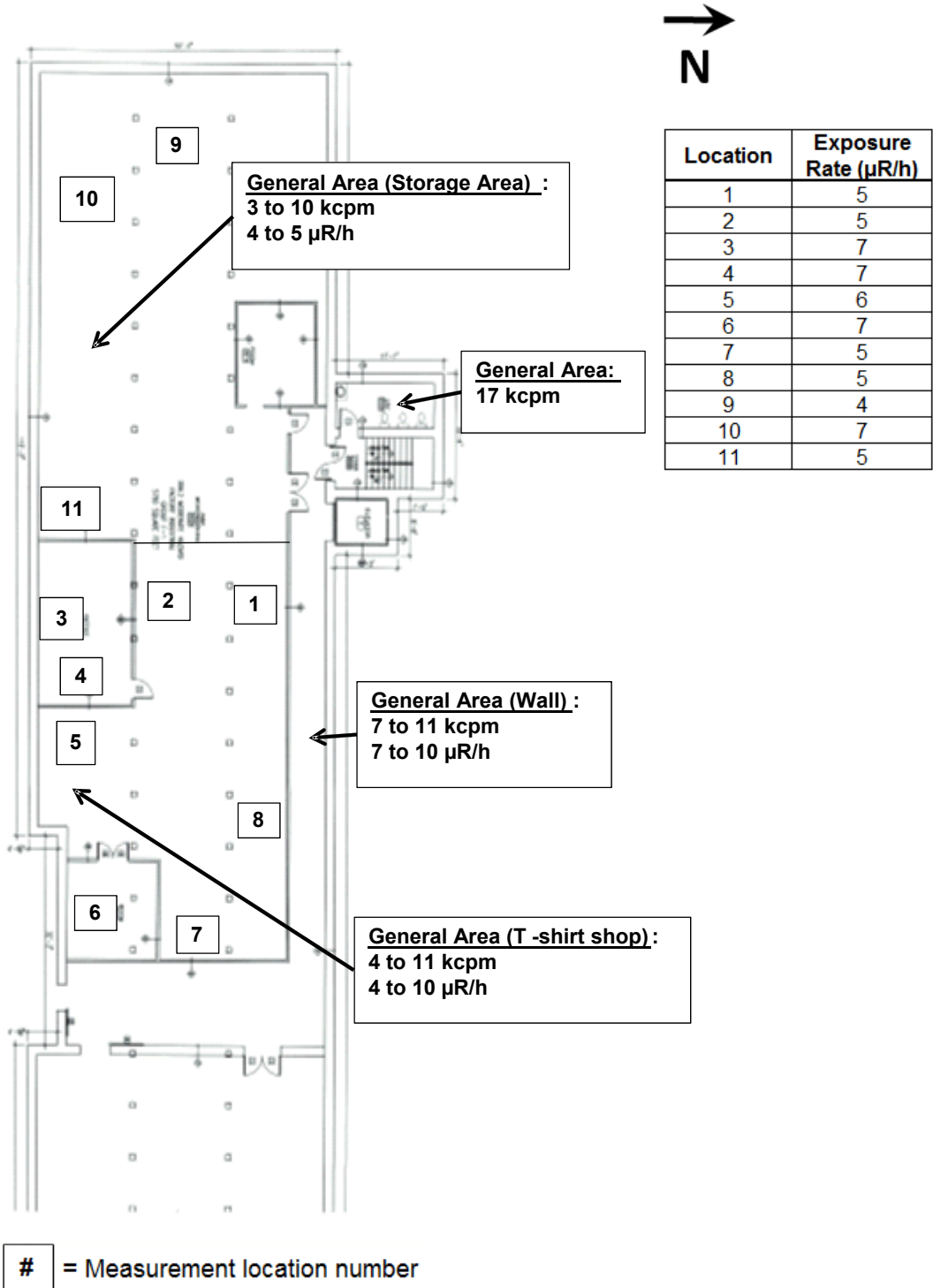
**General Area (All 3rd Floor):**  
 4 to 13 kcpm  
 3 to 10  $\mu$ R/h

# = Measurement location number



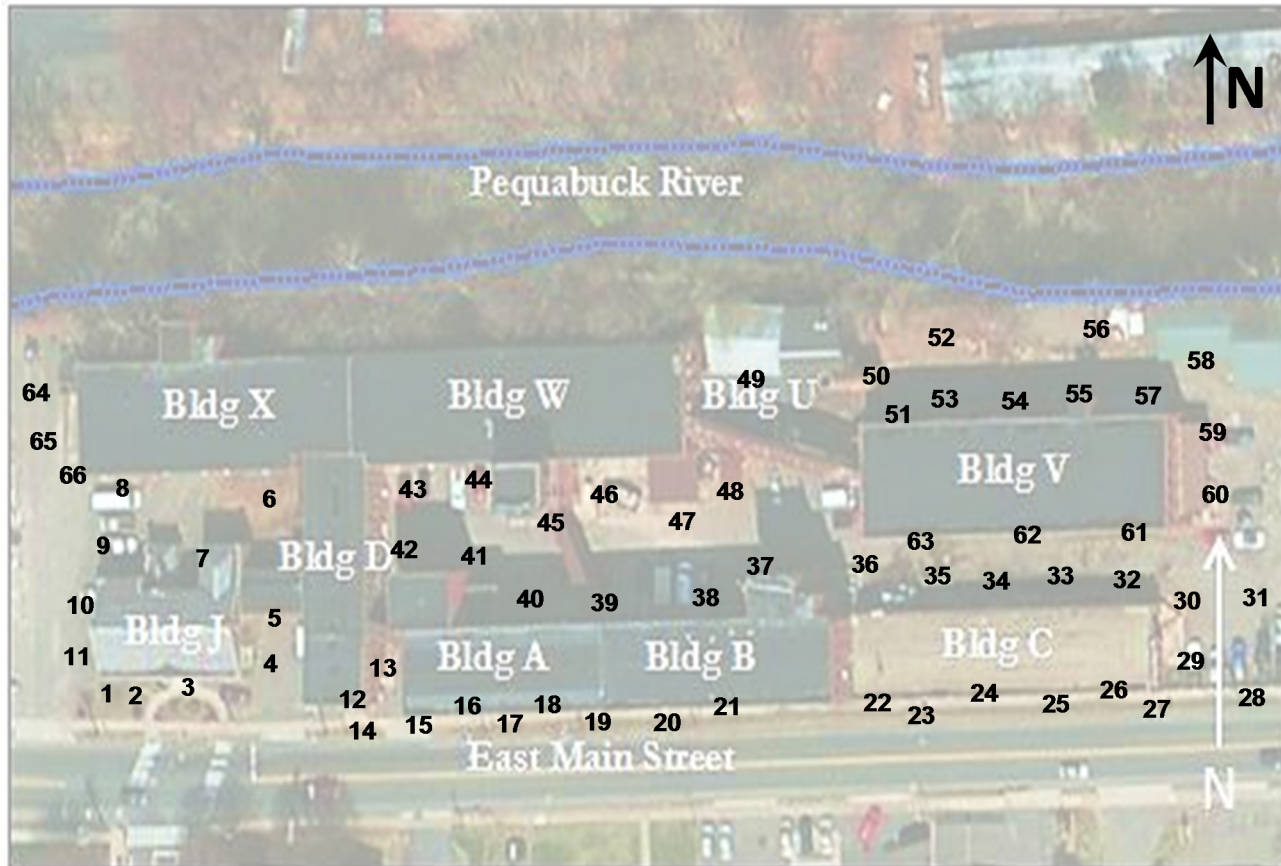
<b>Site:</b> Sessions	<b>Area:</b> Building X - 3rd Floor	<b>Date(s):</b> 12/19/2016	<b>Time:</b> 12:55
<b>Surveyor(s):</b> NAA/JDL		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590	44-10 No. 908	5 to 18 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	4 to 20 μR/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



<b>Site:</b> Sessions	<b>Area:</b> Land Area	<b>Date(s):</b> 2/1/2017	<b>Time:</b> 13:35
<b>Surveyor(s):</b> KME/STP		<b>Purpose:</b> Site Visit	
<b>Radiation Type</b>	<b>Instrument</b>	<b>Detector</b>	<b>Background</b>
Gamma	2221 No. 590 / 1143	44-10 No. 908 / 664	6 - 30 kcpm <sup>a</sup>
Exposure Rate (gamma)	192 No. 1127 / 1129	NA	5 - 12 $\mu$ R/h <sup>a</sup>

<sup>a</sup>Background varied depending on naturally occurring radioactive material in the area.



# = measurement location number

See attached table for measurement results

Sessions Measurement & Smear Results - Outside Areas				
Location No.	Gamma <sup>a</sup>			Comments
	Contact		1 m	
	cpm	µR/hr	µR/hr	
1	8,000	—	8	
2	11,000	—	9	
3	30,000	25	—	Elevated due to granite stairs
4	9,000	—	7	
5	11,000	—	10	
6	13,000	—	12	
7	11,000	—	10	
8	8,500	—	7	
9	9,000	—	8	
10	30,000	25	—	Elevated due to granite stairs
11	8,000	—	7	
12	12,000	—	10	
13	10,000	—	10	
14	7,000	—	7	
15	8,000	—	7	
16	13,000	—	11	
17	9,000	—	7	
18	9,000	—	8	grass
19	9,000	—	7	
20	8,500	—	7	
21	9,500	—	8	grass
22	10,000	—	8	grass
23	9,500	—	7	
24	9,500	—	8	grass
25	9,000	—	7	
26	9,000	—	8	grass
27	7,000	—	7	grass
28	6,000	—	5	
29	10,000	—	10	
30	8,000	—	8	
31	6,500	—	5	
32	13,000	—	10	
33	12,000	—	10	
34	20,000	—	12	

Sessions Measurement & Smear Results - Outside Areas				
Location No.	Gamma <sup>a</sup>			Comments
	Contact		1 m	
	cpm	?R/hr	?R/hr	
35	10,000	—	7	
36	8,500	—	7	
37	9,400	—	9	
38	11,400	—	9	
39	11,000	—	10	
40	12,500	—	11	brick
41	10,500	—	10	
42	13,500	—	11	
43	11,000	—	9	
44	11,500	—	11	
45	8,300	—	7	
46	8,100	—	7	
47	8,200	—	7	
48	8,600	—	8	
49	10,000	—	9	
50	12,000	—	11	
51	12,200	—	11	
52	12,300	—	11	
53	10,000	—	9	
54	11,800	—	10	
55	9,500	—	8	
56	11,700	—	10.5	
57	10,900	—	9	
58	8,000	—	7	
59	9,000	—	7	
60	8,000	—	7	
61	11,000	—	9	
62	10,500	—	9	
63	10,000	—	8	
64	8,000	—	6	
65	7,000	—	6	
66	8,000	—	7	
a) Ludlum 44-10 NaI with Ludlum 2221 rate meter; Ludlum 192 NaI — indicates measurement not collected at this location				

**APPENDIX C  
ENDNOTES**

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<sup>i</sup> Both industrial and residential building occupant scenarios were considered in DandD Version 2.4 (NRC 2001). Default parameters were used for the industrial occupancy scenario, except for the resuspension factor, which was revised to be consistent with the recommended distribution in NUREG-1720 (NRC 2002), in which the NRC staff re-evaluated the default resuspension factor in DandD. Parameter values for the residential occupancy scenario were the same as the industrial occupancy scenario except for the occupancy time, which was set to 6,800 hours. Radium (i.e., Ra226+C) surface concentrations were set at 1,700 dpm/100 cm<sup>2</sup> over a localized area based on observed areas of elevated measurements (i.e., an area equal to about 1 m<sup>2</sup>, which conservatively combines four areas of elevated measurements each less than <0.3 m<sup>2</sup> per area) for both scenarios. The resulting calculated inhalation doses are about 1 mrem/yr and about 2 mrem/yr, for the industrial and residential occupancy scenarios, respectively (rounded to one significant digit).

<sup>ii</sup> Estimates of potential secondary ingestion were developed using DandD Version 2.4 as discussed for the inhalation doses above in endnote i. However, the removable fraction was modified to 1% (from 10% default) to account for observed removable fraction. The resulting secondary ingestion doses are 0.2 and 0.4 mrem/yr for the industrial and residential occupancy scenarios, respectively (rounded to one significant digit).