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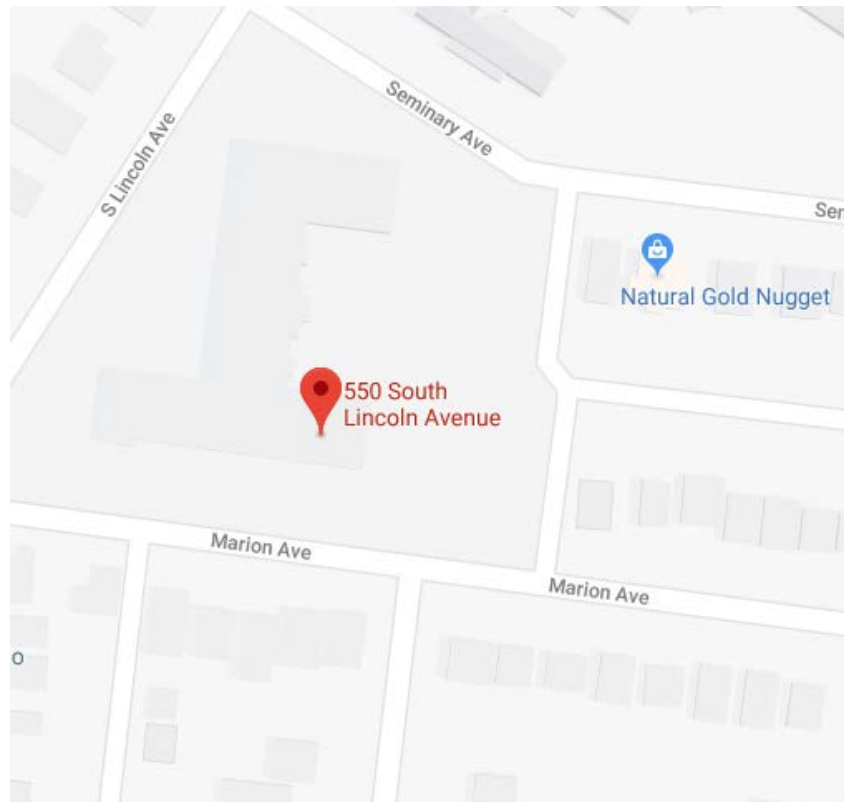
## Radon Measurement Survey Report

Site:

**Bardwell Elementary School**  
**550 South Lincoln Avenue**  
**Aurora, Illinois 60505**

Survey Dates: May 2, 2018 thru May 4, 2018

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Prepared For:

**East Aurora School District 131**  
**417 Fifth Street**  
**Aurora, Illinois 60505**


Carnow Conibear Project No. A146000137



## Radon Measurement Survey Report

Site:

**Bardwell Elementary School  
550 South Lincoln Avenue  
Aurora, Illinois 60505**

Surveyed by:   
\_\_\_\_\_  
Nicole Bennett  
Radon Measurement Professional

Report by:   
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Nicole Bennett  
Radon Measurement Professional

Reviewed by:   
\_\_\_\_\_  
Derek Lantry  
Director, Technical Services

Report Issued: July 3, 2018

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## **1.0 EXECUTIVE SUMMARY**

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Carnow, Conibear, & Assoc., Ltd. (Carnow Conibear) was contracted by East Aurora School District 131 to perform a radon measurement survey at the Bardwell Elementary School located at 550 South Lincoln Avenue in Aurora, Illinois. The survey was initiated on May 2, 2018 and completed on May 4, 2018 by Nicole Bennett, an Illinois Emergency Management Agency (IEMA) licensed Radon Measurement Professional (License No. RNI2016213). The scope of work included short-term (two to four day) radon measurements in frequently occupied rooms with substantial ground contact. The radon sampling was performed following IEMA and the United States Environmental Protection Agency (USEPA) testing protocols for commercial and school radon measurements, the radon device manufacturer's recommendations, and Carnow Conibear's Quality Assurance Plan.

A total of thirty-nine (39) radon test devices were deployed including thirty-four (34) single devices, three (3) duplicates, and two (2) blanks. Activated radon charcoal devices manufactured by Air Chek Inc. were utilized during the radon survey. The activated charcoal devices are passive devices containing activated carbon to measure radon. Testing was initiated on May 2, 2018 and completed on May 4, 2018.

Radon measurement results ranged from less than (<) 0.3 to 1.1 PicoCuries per liter (pCi/L). The radon measurement results indicate areas tested were below the EPA and IEMA recommended action level of 4.0 pCi/L during the time of the test. The average indoor radon concentrations are 1.3 pCi/L nationwide. The average outdoor radon concentration is 0.4 pCi/L.

Based on the radon measurement results Carnow Conibear recommends routine follow-up radon measurement survey every three (3) years, preferably at different seasonal times of the year. Additional radon testing is recommended if significant changes are made to the building's structural or mechanical components.

## **2.0 BACKGROUND**

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Radon is a naturally occurring, radioactive, colorless, odorless, tasteless gas produced from the decay of uranium and radium found in most soil and rock. Natural soils and rock such as granites, shales, and corals, contaminated soils from uranium processing mills, contaminated building materials, and groundwater water supplies directly from wells are a few common sources of radon. Radon can be found at some level in all indoor and outdoor air. Unlike most airborne contaminants radon is chemically inert, or chemically inactive. As a result, it is not chemically bound or attached to other materials and can move easily through porous materials or void space.

Typically, most radon gas is generated from the surrounding soil or bedrock, pulled through the soil or rock by air pressure differentials and enters the structure. However, radon gas can come from water, outside air, or contaminated building materials. The strength of the radon source has the biggest impact on indoor radon concentrations. The route of entry (i.e. through holes in the foundation), the building's ventilation rate, foundation type and differences in soils beneath the building can affect the indoor radon concentrations.

The primary health effect attributed to radon exposure is lung cancer. The World Health Organization (WHO), the National Academy of Sciences, the US Department of Health and Human Services, and the EPA classify radon as known human carcinogen. The EPA states radon is the largest source of radiation exposure and risk to the general public. When radon and products of radon decay are inhaled, decay can occur while in contact with the lung prior to being expelled. Because radon is chemically inert, most inhaled radon is rapidly exhaled. However, the inhaled decay products are readily deposited in the lungs, release energy in the form of radiation causing lung tissue damage and consequently increase the risk of lung cancer.

Radon concentrations in air are commonly expressed in picoCuries per liter (pCi/L) in the United States. An EPA national residential radon survey completed in 1991, determined the average indoor radon level is 1.3 pCi/L and the average outdoor level is about 0.4 pCi/L. The National Academy of Sciences' (NAS) latest report on radon, the Biological Effects of Ionizing Radiation (BEIR) VI Report (1999) estimates radon in indoor air causes about 21,000 lung cancer deaths each year in the United States. The EPA states that any level of radon carries some risk, there are no safe levels, and has established an action level of 4.0 pCi/L.

## **3.0 SCOPE OF WORK**

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Carnow, Conibear was contracted by East Aurora School District 131 to perform a radon survey at the Bardwell Elementary School located at 550 South Lincoln Avenue in Aurora, Illinois.

The scope of work included short-term radon measurements in frequently occupied rooms with substantial ground contact. The duration of short-term measurements can range from two (2) to four (4) days. Prior to placement of the radon measurement devices a Quality Assurance Project Plan (QAPP) was developed and general observations were performed to verify test conditions, identify device placement locations, and determine structural and mechanical building components. The QAPP was created to document and describe the necessary quality assurance procedures, quality control activities, and provide a clear, concise, and complete plan for the radon measurement operations. Observations of test conditions verified closed building conditions were maintained at a minimum of twelve (12) hours prior to testing and throughout the measurement period. Closed building conditions are necessary for short-term radon measurements in order to stabilize the radon and radon decay product concentrations and increase the reproducibility of the measurement. Closed building conditions require windows and exterior doors on all levels be kept closed (except for normal entry and exit) during the measurement period. Closed building conditions also require the normal operation of heating, ventilating, and air condition systems.

Radon test devices were deployed in thirty-four (34) locations. In addition, three (3) duplicates, and two (2) blanks, were utilized to measure precision and bias, and ensure quality data. Radon test devices were documented in a permanent log noting the address of the building measured, a diagram of the test area noting the exact locations of all measurement devices deployed, exact start and stop times of the measurement period, a description of the device used and serial number, and the name and IEMA license number of the Radon Measurement Professional. At the end of the measurement period the radon test devices were retrieved, resealed, and mailed to the laboratory for analysis.

The radon measurement results are reported in picoCurie per liter. A picoCurie per liter is 2.22 atomic radon disintegrations per minute for each liter of air. The results of the radon measurements are interpreted to determine the need for additional testing and assess the quality and confidence of the measurement data. Typically, follow-up measurements will be recommended in every room with results greater than 4.0 pCi/L. The recommendation to mitigate elevated levels of radon shall not be based on the initial measurement results.

## 4.0 METHODOLOGY

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The radon testing was performed following requirements set forth by the IEMA, USEPA, and Carnow Conibear's Quality Assurance Plan. The radon measurement survey consisted of several phases. The initial phase consisted of preliminary testing protocol, including an explanation of services, instructions to comply with closed building conditions, the development of the Quality Assurance Project Plan, and determination of the testing period. Next, general observations of the building were performed to verify test conditions, identify device placement locations, and determine structural and mechanical building components.

The measurement phase included the radon testing device placement and retrieval. Activated radon charcoal devices manufactured by Air Chek Inc. were utilized during this radon survey. The activated charcoal devices are passive devices containing activated carbon to measure radon. Radon test devices were placed in such a way to limit unintentional interference from building occupants. The measurement devices were placed at least three feet from doors, windows to the outside, at least one foot from exterior walls, at least four feet from heat sources, out of the direct flow of ventilation ducts and sunlight, and suspended in the general breathing zone. Duplicate tests were conducted for a minimum of 10% of the total radon test devices deployed to measure precision. Field blanks were submitted for a minimum of 5% of the total number of radon test devices deployed to measure background gamma radiation. Spike tests were not submitted for this survey but are submitted for a minimum of three per 100 radon test devices or a minimum of three per year to measure laboratory accuracy. A total of thirty-nine (39) radon test devices were deployed including thirty-four (34) single devices, three (3) duplicates, and two (2) blanks. At the end of the measurement period the radon measurement devices were retrieved, resealed, and shipped overnight to Air Chek Inc. for analysis. Air Chek Inc. calculates the radon concentration after measuring the gamma activity by the radon decay products produced from the random decay of the collected radon. The final phase consisted of interpreting the results and an assessment of the quality and confidence of the measurement data.

## **5.0 SUMMARY OF RESULTS**

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Table 1.0 Radon Measurement Device Results identify all the radon measurement devices deployed and the reported radon results. The radon measurement results are reported in picoCurie per liter (pCi/L).

Radon measurement results were below 4.0pCi/L. The radon measurement results indicate areas tested were below the EPA and IEMA recommended action level of 4.0 pCi/L during the time of the test. No Radon mitigation systems were observed in the building. Additionally, the following testing abnormalities were noted during the radon measurement interval:

- The device (serial #9043089) deployed in Classroom 1 was missing at the time of retrieval



**Table 1.0 Radon Measurement Device Results**

**Bardwell Elementary School  
550 South Lincoln Avenue  
Aurora, Illinois 60505**

<b>Device Location</b>	<b>Device Serial #</b>	<b>Start Date</b>	<b>Start Time</b>	<b>Stop Date</b>	<b>Stop Time</b>	<b>Result (pCi/L)</b>	<b>Comments</b>
Main Office 9 PA	9043081	5/2/2018	5:41 PM	5/4/2018	5:47 PM	0.5	
Main Office 9A	9043082	5/2/2018	5:42 PM	5/4/2018	5:48 PM	0.8	
Nurse's Office 9B	9043083	5/2/2018	5:43 PM	5/4/2018	5:48 PM	0.6	
Main Office 2E	9043084	5/2/2018	5:44 PM	5/4/2018	5:49 PM	0.7	
Office 2D	9043085	5/2/2018	5:45 PM	5/4/2018	5:49 PM	0.5	
Office 2C	9043086	5/2/2018	5:46 PM	5/4/2018	5:50 PM	0.6	
Office 2B	9043087	5/2/2018	5:47 PM	5/4/2018	5:50 PM	0.7	
Music Room 2	9043088	5/2/2018	5:50 PM	5/4/2018	5:50 PM	0.9	
Classroom 1	9043089	5/2/2018	5:51 PM	5/4/2018	---	---	Device Missing
Classroom 3	9043090	5/2/2018	5:53 PM	5/4/2018	6:10 PM	0.9	
Classroom 3	9043091	5/2/2018	5:53 PM	5/4/2018	6:10 PM	0.8	Duplicate RPD = 11.8%
Classroom 5	9043092	5/2/2018	5:55 PM	5/4/2018	6:11 PM	0.7	
Classroom 8	9043093	5/2/2018	5:57 PM	5/4/2018	6:11 PM	0.8	
Classroom 8	9043094	5/2/2018	5:58 PM	5/4/2018	6:12 PM	0.8	
Classroom 4	9043095	5/2/2018	6:00 PM	5/4/2018	6:27 PM	0.8	
Classroom 6	9043096	5/2/2018	6:01 PM	5/4/2018	6:12 PM	1.0	
Learning Center 8B	9043097	5/2/2018	6:04 PM	5/4/2018	6:13 PM	< 0.3	
Learning Center 8B	9043098	5/2/2018	6:04 PM	5/4/2018	6:14 PM	< 0.3	
Computer Lab 8C	9043099	5/2/2018	6:05 PM	5/4/2018	6:15 PM	< 0.3	
Staff Lounge 11	9043100	5/2/2018	6:08 PM	5/4/2018	6:13 PM	0.6	
Classroom 13	9044301	5/2/2018	6:09 PM	5/4/2018	6:16 PM	0.6	

**Table 1.0 Radon Measurement Device Results**

**Bardwell Elementary School  
550 South Lincoln Avenue  
Aurora, Illinois 60505**

Device Location	Device Serial #	Start Date	Start Time	Stop Date	Stop Time	Result (pCi/L)	Comments
Classroom 13	9044302	5/2/2018	6:09 PM	5/4/2018	6:16 PM	0.7	Duplicate RPD = 15.4%
Cafeteria 17	9044303	5/2/2018	6:12 PM	5/4/2018	6:14 PM	< 0.3	
Custodian Room 19	9044304	5/2/2018	6:14 PM	5/4/2018	6:14 PM	0.7	
Multipurpose Room 21	9044305	5/2/2018	6:15 PM	5/4/2018	6:16 PM	1.1	
Cafeteria 14	9044306	5/2/2018	6:18 PM	5/4/2018	6:18 PM	0.6	
Room 7	9044307	5/2/2018	6:25 PM	5/4/2018	6:28 PM	< 0.3	
Room 9	9044308	5/2/2018	6:26 PM	5/4/2018	6:29 PM	0.7	
Room 9	9044309	5/2/2018	6:26 PM	5/4/2018	6:29 PM	0.6	Duplicate RPD = 15.4%
Room 9A	9044310	5/2/2018	6:27 PM	5/4/2018	6:29 PM	0.7	
Room 9B	9044311	5/2/2018	6:30 PM	5/4/2018	6:30 PM	< 0.3	
Classroom 10	9044312	5/2/2018	6:32 PM	5/4/2018	6:33 PM	0.5	
Classroom 12	9044313	5/2/2018	6:34 PM	5/4/2018	6:34 PM	< 0.3	
Classroom 15	9044314	5/2/2018	6:36 PM	5/4/2018	6:36 PM	0.6	
Room 29	9044315	5/2/2018	6:38 PM	5/4/2018	6:38 PM	< 0.3	
Room 27	9044316	5/2/2018	6:39 PM	5/4/2018	6:39 PM	0.8	
Room 25	9044317	5/2/2018	6:41 PM	5/4/2018	6:41 PM	0.5	
Hallway	9044318	5/2/2018	6:42 PM	5/4/2018	6:42 PM	< 0.3	Blank
Hallway	9044319	5/2/2018	6:42 PM	5/4/2018	6:42 PM	< 0.3	Blank

RPD - Relative Percent Difference = difference divided by the average of simultaneous results times 100. Results less than 4.0 pCi/L shall agree with a RPD of less than 67 percent. Results greater than 4.0 pCi/l shall agree with a RDP of less than 36 percent.  
The EPA and IEMA recommended radon action level is 4.0 pCi/L.

## 6.0 CONCLUSIONS

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Carnow, Conibear, & Assoc., Ltd. (Carnow Conibear) was contracted by East Aurora School District 131 to perform a radon survey at the Bardwell Elementary School located at 550 South Lincoln Avenue in Aurora, Illinois. The survey was initiated on May 2, 2018 and completed on May 4, 2018 by Nicole Bennett, an Illinois Emergency Management Agency (IEMA) licensed Radon Measurement Professional (License No. RNI2016213). The scope of work included short-term (two to four day) radon measurements in frequently occupied rooms with substantial ground contact. The radon survey was performed in following the IEMA and the USEPA testing protocols for commercial and school radon measurements, the radon device manufacturer's recommendations, and the Carnow Conibear Quality Assurance Plan.

Radon measurement results ranged from less than (<) 0.3 to 1.1 pCi/L. The radon measurement results indicate radon concentrations for areas tested were below the EPA and IEMA recommended action level of 4.0 pCi/L during the time of the test. The average indoor radon concentrations are 1.3 pCi/L nationwide. The average outdoor radon concentration is 0.4 pCi/L.

Based on the radon measurement results Carnow Conibear recommends the following:

- A routine follow-up radon measurement survey every three (3) years, preferably at different seasonal times of the year. Follow-up radon testing is also recommended in locations with invalid test results.
- Additional radon testing if significant changes are made to the building's structural or mechanical components.

## **7.0 LIMITATIONS AND CONDITIONS**

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The information contained in this report was prepared for the exclusive use and reliance of East Aurora School District 131 and Carnow Conibear. This information is based on the specific parameters of the scope of work for this project and the regulations in force at the time of the report.

Carnow Conibear has applied prevailing industry standards and reasonable judgment and effort within the scope of work, while conducting the radon measurement survey. The standards, judgment, and effort used by Carnow Conibear personnel to investigate, assess, and determine the presence of potential environmental hazards and liabilities associated with the radon survey at the Bardwell Elementary School, Aurora, Illinois are consistent with requirements outlined in federal and state guidelines. Carnow Conibear makes no warranty, express or implied, that the findings and interpretations in this report are a complete representation of the environmental hazards and liabilities, associated with the Bardwell Elementary School, Aurora, Illinois.

# APPENDIX A

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## Floor Plans – Radon Sampling Locations



## APPENDIX B

Laboratory Analysis Report

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Radon test result report for:

**BARDWELL ELEMENTARY SCHOOL  
550 SOUTH LINCOLN AVENUE, AURORA, I**

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9044306	CAFETERIA 14	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08
9044303	CAFETERIA 17	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	< 0.3	2018-05-08
9044312	CLASSROOM 10	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	0.5 ± 0.3	2018-05-08
9044313	CLASSROOM 12	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	< 0.3	2018-05-08
9044301	CLASSROOM 13	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08
9044302	CLASSROOM 13	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9044314	CLASSROOM 15	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	0.6 ± 0.3	2018-05-08
9043091	CLASSROOM 3	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.8 ± 0.3	2018-05-08
9043090	CLASSROOM 3	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.9 ± 0.3	2018-05-08
9043095	CLASSROOM 4	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.8 ± 0.3	2018-05-08
9043092	CLASSROOM 5	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9043096	CLASSROOM 6	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	1.0 ± 0.3	2018-05-08
9043093	CLASSROOM 8	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.8 ± 0.3	2018-05-08
9043094	CLASSROOM 8	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.8 ± 0.3	2018-05-08
9043099	COMPUTER LAB 8C	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	< 0.3	2018-05-08
9044304	CUSTODIAN ROOM 19	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9044318	HALLWAY	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	< 0.3	2018-05-08
9044319	HALLWAY	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	< 0.3	2018-05-08
9043098	LEARNING CENTER 8B	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	< 0.3	2018-05-08
9043097	LEARNING CENTER 8B	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	< 0.3	2018-05-08
9043084	MAIN OFFICE 2E	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9043081	MAIN OFFICE 9 PA	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.5 ± 0.3	2018-05-08
9043082	MAIN OFFICE 9A	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.8 ± 0.3	2018-05-08
9044305	MULTIPURPOSE ROOM 21	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	1.1 ± 0.3	2018-05-08
9043088	MUSIC ROOM 2	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.9 ± 0.3	2018-05-08
9043083	NURSE&APOS;S OFFICE 9B	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08
9043087	OFFICE 2B	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9043086	OFFICE 2C	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08
9043085	OFFICE 2D	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.5 ± 0.3	2018-05-08
9044317	ROOM 25	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	0.5 ± 0.3	2018-05-08
9044316	ROOM 27	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	0.8 ± 0.3	2018-05-08
9044315	ROOM 29	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	< 0.3	2018-05-08
9044307	ROOM 7	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	< 0.3	2018-05-08
9044308	ROOM 9	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9044309	ROOM 9	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08
9044310	ROOM 9A	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.7 ± 0.3	2018-05-08
9044311	ROOM 9B	2018-05-02 @ 7:00 pm	2018-05-04 @ 7:00 pm	< 0.3	2018-05-08



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May 10, 2018

**\*\* LABORATORY ANALYSIS REPORT \*\***

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Radon test result report for:

**BARDWELL ELEMENTARY SCHOOL**  
**550 SOUTH LINCOLN AVENUE, AURORA, I**

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<b>Kit #</b>	<b>Room Id</b>	<b>Started</b>	<b>Ended</b>	<b>pCi/L</b>	<b>Analyzed</b>
9043100	STAFF LOUNGE 11	2018-05-02 @ 6:00 pm	2018-05-04 @ 6:00 pm	0.6 ± 0.3	2018-05-08

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Air Chek, Inc. 1936 Butler Bridge Rd, Mills River, NC 28759-3892 Phone: (828) 684-0893 Fax: (828) 684-8498

## APPENDIX C

Radon Measurement Professional License

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*Bruce Rauner*  
Governor

State of Illinois  
IEMA Division of Nuclear Safety

*James K. Joseph*  
Director

Pursuant to the Radon Industry Licensing Act, 420 ILCS 44 et seq. and 32 Illinois Administrative Code 422, Licensing of Radon Detection and Mitigation Services, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued.

This is to certify that **Nicole Bennett**

License Number **RNI2016213**

has met the requirements for **Radon Measurement Professional**

Issued - Expires **05/18/2016 - 05/31/2021**

Limited to **Radon measurements of residential real estate, home environment, school and commercial buildings only.**



161391001

*Patrick I. Daniels*

Patrick I. Daniels, Radon Program