

# Coleman Creek Consulting, Inc.

## **INITIAL RADON AIR SAMPLING OF KENO ELEMENTARY SCHOOL FOR KLAMATH COUNTY SCHOOL DISTRICT 2845 GREENSPRINGS DRIVE, KLAMATH FALLS, OREGON**

### **INTRODUCTION**

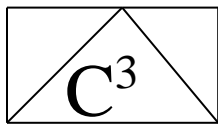
Coleman Creek Consulting, Inc. (CCC) was retained by Klamath County School District (KCSO) to perform radon air sampling as required by State Statute ORS 332.166-167. KCSO is required to perform complete radon air testing of District owned and occupied facility buildings by January 1, 2021. The purpose of the initial radon air sampling was to collect radon air samples from all regularly occupied rooms within school buildings, with the exception of storage, restrooms, kitchen, locker rooms, and compare analytical results with the EPA recommended “Action Level” concentration for radon. Short-term radon air sampling was selected for this project.

### **RADON INFORMATION AND HEALTH EFFECTS**

Radon is a naturally occurring radioactive gas that is produced by natural deposits of uranium in soil, and is found world-wide. Uranium naturally decays into Radium, and Radium can produce Radon gas. Radon gas can travel up through soil and enter buildings in contact with soil. Radon gas entering a building may become concentrated in the lowest part of the building in areas with little fresh air mixing. If radon is inhaled into lungs, particle decay processes can release radiation, potentially damaging lung tissue, and over time leading to lung cancer. The Environmental Protection Agency (EPA) has estimated that Radon is the primary cause of lung cancer among non-smokers. EPA recommends reducing the concentration of Radon in indoor environments to below the Action Level of 4.0 pCi/L (pico-curies per Liter of air).

### **INITIAL RADON AIR SAMPLING**

David W. Fawcett of CCC trained KCSO employees, including school custodians in radon sampling procedures December 4, 2020. Michael Mattingly, Keno Elementary School (KES) Custodian placed radon air test kits in the KES building at the beginning of the day, December 7, 2020. A total of 27 locations were sampled according to guidelines established in the Oregon Health Authority (OHA) “Testing for Elevated Radon in Oregon Schools, A Protocol and Plan”, dated 2016. Mr. Mattingly returned to the KES building December 10, 2020, at the beginning of the day, and collected all radon test kits placed for sampling. See Radon Air Sample Record Sheets (pages 4-5) for locations of all areas sampled. All samples collected were packaged by Mr. Fawcett, and sent overnight to Air Chek, Inc., in Mills River, North Carolina for analysis.



# Coleman Creek Consulting, Inc.

## **LABORATORY ANALYSIS RESULTS**

The radon air test kit samples collected from KES building were reported ranging from <0.3 to 3.7 pCi/L (picocuries per liter of air). A complete listing of laboratory results and locations is found in the Air Chek, Inc. Laboratory Analysis Report in Appendix A.

## **QUALITY ASSURANCE**

To ensure that test results are reliable and accurate, quality assurance samples, including duplicate test kits (placed in same room), blank test kits (not sampled at all), and spike sampling (exposing test kits to a measured amount of radon prior to laboratory submission) were all employed during Radon sampling. The number of duplicate, blank, and spike test kits utilized during sampling followed OHA testing protocol guidelines.

## **DUPLICATE TEST KITS**

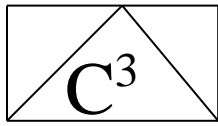
A total of two duplicate test kits were placed during initial test kit sampling. See duplicate designation on the Radon Air Sample Record Sheets. The two duplicate test kit sets were reported with paired concentrations of 0.7/<0.3 pCi/L, and 0.9/0.8 pCi/L. The Relative Percent Difference for each pair was 80%, and 12%. The last pair was within the expected range of 0-25% Relative Percent Difference, with the other pair was reported with concentrations <2.0 pCi/L, indicating Radon concentrations were too low to apply the Relative Percent Difference test.

## **BLANK TEST KITS**

The blank test kit submitted to Air Chek with the other KES Radon test kits. The blank test kit was reported with <0.3 pCi/L. The blank test kit was reported none detected for Radon.

## **SPIKE TEST KIT ANALYSIS**

One test kit was submitted to Bowser-Morner for Radon Spike processing. The test kit was exposed to 25.7 pCi/L for three days from December 4 through December 7, 2020. See Appendix B for the Bowser-Morner Radon Exposure test information. The “Spiked” test kit was submitted to Air Chek for analysis along with the other TES Radon test kits. The Spike sample was reported with 15.7 pCi/L. The relative percentage error was calculated to be -39%, in the out of control range (greater than -30%). The Spike lab Bowser-Moerner was contacted, and did not report any unusual occurrence during Spike activities. The analytical lab (Air Chek) was contacted, and no unusual occurrences were noted during test kit analysis. Spike test kits were shipped twice during cold temperatures, and that may have had an effect on the Spike sample results. In addition, the complete KCS D Spike sample results exhibit a rather uniform grouping, with results ranging from 13.0 to 17.3 pCi/L, all below the Spiked concentration of 25.7 pCi/L. The Spike sample is identified as Serial #9418465 on the Laboratory Analysis Report in Appendix A.



## **RADON RESULTS AND FUTURE ACTIONS**

The 2016 OHA Testing of Elevated Radon in Oregon Schools Protocol and Plan describes future steps to take based on initial Radon sample results. The following is a description of recommended actions based on Radon concentrations reported.

1. If <2.0 pCi/L Radon is reported, ORS 332.166-167 requires Radon re-test every 10 years.
2. If 2.0 pCi/L to 4.0 pCi/L Radon is reported, consider lowering the Radon concentration in the room.
3. If 4.0 pCi/L to 8.0 pCi/L Radon is reported, perform follow-up Radon measurement in the affected room(s) using a long-term test. Conduct over the school year as much as possible. If that result is equal to or greater than 4.0 pCi/L, Radon concentration in the room should be lowered.
4. If equal to or greater than 8.0 pCi/L Radon is reported, conduct a second short-term test and average the result with the initial Radon result. If the average result of the two short-term tests is equal to or greater than equal to or greater than 4.0 pCi/L, Radon concentration in the room should be lowered.

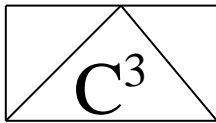
## **DISCUSSION OF INTIAL RADON SAMPLING RESULTS**

The initial Radon short-term sampling in Keno Elementary School building was reported with Radon concentrations ranging from <0.3 to 3.7 pCi/L. All Radon test kit samples were reported < 4.0 pCi/L, indicating that a re-test should be performed in 10 years.

CCC appreciates the opportunity to provide initial radon air testing and consulting to Klamath County School District.

Sincerely,

David W. Fawcett  
Director of Consulting Operations



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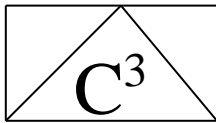
## RADON AIR SAMPLE RECORD SHEET

SCHOOL: Keno Elementary School  
ADDRESS: 11110 Keno Worden Road  
Keno, Oregon

DATE: 12-07-20/12-10-20  
SAMPLER: Michael Mattingly

SERIAL #	BUILDING	Duplicate	LOCATION	START TIME	STOP TIME
9418435	Main		<b>1 – Cafeteria</b>	0631	0631
9418436	Main		<b>2 – Room 2</b>	0634	0634
9418437	Main		<b>3 – Room 1</b>	0637	0635
9418438	Main		<b>4 – Room 3</b>	0639	0637
9418439	Main		<b>5 – Room 4</b>	0640	0638
9418440	Main		<b>6 – Library</b>	0643	0640
9418441	Main		<b>7 – Conference Room</b>	0645	0642
9418442	Main		<b>8 – Room 5</b>	0647	0643
9418443	Main		<b>9 – Office</b>	0650	0644
9418444	Main		<b>10 – Health Room</b>	0653	0647
9418445	Main	Yes	<b>10 – Health Room</b>	0653	0647
9418446	Main		<b>11 – Principal Office</b>	0655	0648
9418447	Main		<b>12 – Staff Break Room</b>	0657	0650
9418448	Main		<b>13 – Room 6</b>	0659	0651
9418449	Main		<b>14 – Room 8</b>	0700	0652
9418450	Main		<b>15 – Room 9</b>	0702	0654
9418451	Main		<b>16 – Room 7</b>	0703	0655
9418452	Main		<b>17 – Room 10</b>	0706	0657
9418453	Main		<b>18 – Room 11</b>	0708	0658
9418454	Main		<b>19 – Room 12</b>	0710	0659
9418455	Main		<b>20 – Room 14</b>	0713	0700
9418456	Main	Yes	<b>20 – Room 14</b>	0713	0700

Comments: **Spike Sample =**  
**Blank Sample = 9418457**



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## RADON AIR SAMPLE RECORD SHEET

SCHOOL: Keno Elementary School  
ADDRESS: 11110 Keno Worden Road  
Keno, Oregon

DATE: 12-07-20/12-10-20  
SAMPLER: Michael Mattingly

SERIAL #	BUILDING	Duplicate	LOCATION	START TIME	STOP TIME
9418458	Main		<b>21 – Connelison Office</b>	0715	0702
9418459	Main		<b>22 – Room 15</b>	0717	0703
9418460	Main		<b>23 – Room 16</b>	0719	0704
9418461	Main		<b>24 – Gym East</b>	0722	0705
9418462	Main		<b>25 – Gym NE</b>	0724	0706
9418463	Main		<b>26 – Gym NW</b>	0726	0707
9418464	Main		<b>27 – Gym West</b>	0727	0708

Comments: **Spike Sample = 9418465**  
**Blank Sample =**

**APPENDIX A**

**AIR CHEK LABORATORY ANALYSIS REPORT**

Radon test result report for:**KENO ES****20570700**

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9418435	CAFETERIA	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418436	2	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9418437	1	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9418438	3	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9418439	4	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418440	LIBRARY	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.4	2020-12-15
9418441	CONFER.	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.4	2020-12-15
9418442	5	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9418443	OFFICE	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.5	2020-12-15
9418444	HEALTH	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.5	2020-12-15
9418445	HEALTH	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418446	PRINCIPAL	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418447	STAFF RM	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9418448	6	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9418449	8	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418450	9	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418451	7	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418452	10	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9418453	11	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418454	13	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.9 ± 0.4	2020-12-15
9418455	14	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.9 ± 0.5	2020-12-15
9418456	14	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9418457	14	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418458	CONNEL.	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	3.7 ± 0.6	2020-12-15
9418459	15	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	1.4 ± 0.5	2020-12-15
9418460	16	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9418461	GYM E	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.4	2020-12-15
9418462	GYM NW	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9418463	GYM W	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.5 ± 0.4	2020-12-15
9418464	GYM W	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9418465	GYM W	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	15.7 ± 1.0	2020-12-15

## **APPENDIX B**

### **BOWSER-MORNER RADON SPIKE EXPOSURE**



# EXPOSURE IN BOWSER-MORNER RADON CHAMBER

CLIENT Coleman Creek Consulting, Inc. Job Number 198582

NOMINAL Conditions: Radon Conc 25.7 pCi/L Rel. Hum 59.0 % Temp. 70.3 F

Date Start: 12/4/20 Date Stop: 12/7/20 Date Start: \_\_\_\_\_ Date Stop: \_\_\_\_\_

Time Start: 0923 Time Stop: 0923 Time Start: \_\_\_\_\_ Time Stop: \_\_\_\_\_

(Group 1)

Device No.'s: (12) Char Bags -

9417935, 9417970, 9418007,

9418060, 9418096, 9418127,

9418163, 9418190, 9418226,

9418250, 9418286, 9418321

Device No.'s: \_\_\_\_\_

R5 Left

Date Start: <sup>rem</sup> 12/4/20 Date Stop: 12/7/20 Date Start: \_\_\_\_\_ Date Stop: \_\_\_\_\_

Time Start: 0927 Time Stop: 0927 Time Start: \_\_\_\_\_ Time Stop: \_\_\_\_\_

(Group 2)

Device No.'s: (13) Char Bags -

9418370, 9418418, 9418465, 9418500,

9418566, 9418601, 9418660,

9418695, 9418771, 9418747,

9418806, 9418846, 9418875

Device No.'s: \_\_\_\_\_

R5 Right

Date Start: \_\_\_\_\_ Date Stop: \_\_\_\_\_ Date Start: \_\_\_\_\_ Date Stop: \_\_\_\_\_

Time Start: \_\_\_\_\_ Time Stop: \_\_\_\_\_ Time Start: \_\_\_\_\_ Time Stop: \_\_\_\_\_

Device No.'s: \_\_\_\_\_ Device No.'s: \_\_\_\_\_

Note: All times are in 24-hour (military) notation, Eastern Standard Time (EST)  
Background = 7  $\mu$ R/h Elevation = 820 ft

**APPENDIX C**

**RADON SAMPLING LOCATION DIAGRAM**

# KENO ELEMENTARY SCHOOL Radon Sample Locations

