

Coleman Creek Consulting, Inc.

INITIAL RADON AIR SAMPLING OF BONANZA SCHOOLS FOR KLAMATH COUNTY SCHOOL DISTRICT 2845 GREENSPRINGS DRIVE, KLAMATH FALLS, OREGON

INTRODUCTION

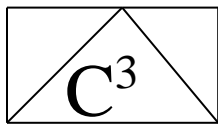
Coleman Creek Consulting, Inc. (CCC) was retained by Klamath County School District (KCS D) to perform radon air sampling as required by State Statute ORS 332.166-167. KCS D is required to perform complete radon air testing of District owned and occupied facility buildings by January 1, 2021. The purpose 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 KCS D employees, including school custodians in radon sampling procedures December 4, 2020. Adam Patterson, Bonanza Schools Custodian placed radon air test kits in the Bonanza Schools (Bonanza) buildings at the beginning of the day, December 7, 2020. A total of 67 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. Patterson returned to Bonanza 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 4-6) 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.



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LABORATORY ANALYSIS RESULTS

The radon air test kit samples collected from Bonanza buildings were reported ranging from <0.3 to 0.9 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

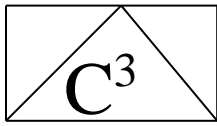
A total of six duplicate test kits were placed during initial test kit sampling. See duplicate designation on the Radon Air Sample Record Sheets. The six duplicate test kit sets were all reported with <0.3 pCi/L. All six duplicate test kits were reported with identical results, with the exception of Serial # 9417922 reported with 0.6 pCi/L. When compared with matched pair or “duplicate” test kits, five were well within the expected range of 0-25% Relative Percent Difference, and the sixth was detected below 2.0 pCi/L, the lowest concentration at which a Relative Percent Difference may be calculated.

BLANK TEST KITS

Three blank test kits were submitted to Air Chek with the other Bonanza Radon test kits. All three blank test kits were reported with <0.3 pCi/L. All blank tests were reported none detected for Radon.

SPIKE TEST KIT ANALYSIS

Two test kits were submitted to Bowser-Morner for Radon Spike processing. The test kits were 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 kits were submitted to Air Chek for analysis along with the other TES Radon test kits. The two Spike samples were reported with 15.8 and 16.7 pCi/L. The relative percentage error was calculated to be -38% and -35%, respectively, 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 two Spike samples are identified as Serial #9417935 and #9417971 on the Laboratory Analysis Report in Appendix A.



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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.

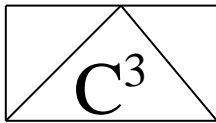
DISCUSSION OF INTIAL RADON SAMPLING RESULTS

The initial Radon short-term sampling in Bonanza Schools buildings were reported with Radon concentrations ranging from <0.3 to 0.9 pCi/L. All Radon test kit samples were reported < 2.0 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



Coleman Creek Consulting, Inc.

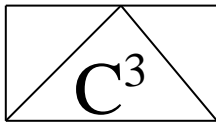
RADON AIR SAMPLE RECORD SHEET

SCHOOL: Bonanza Schools
ADDRESS: 31601 Mission Street
Bonanza, Oregon

DATE: 12-07-20/12-10-20
SAMPLER: Adam Patterson

SERIAL #	BUILDING	Duplicate	LOCATION	START TIME	STOP TIME
9417901	Sm. Gym		1 – Room 8	0644	0621
9417902	Sm. Gym		2 – Room 8	0646	0621
9417903	Original		3 – Room 7	0650	0624
9417904	Original		4 – Room 4	0652	0626
9417905	Original		5 – Room 3	0655	0628
9417906	Original		6 – Room 6	0659	0629
9417907	Original		7 – Room 5	0702	0631
9417908	Original		8 - Room 12	0704	0633
9417909	Original		9 – Room 9	0706	0635
9417910	Original		10 – Room 13	0709	0637
9417911	Original	Yes	10 - Room 13	0709	0637
9417912	Original		11 – Room 10	0712	0639
9417913	Original		12 – Room 11	0715	0641
9417914	Original		13 – Room 14	0719	0642
9417915	Original		14 – Room 30	0723	0645
9417916	Original		15 – Room 32	0726	0646
9417917	Original		16 – Room 33	0728	0648
9417918	Original		17 – Room 29	0730	0650
9417919	Original		18 – Room 29	0731	0650
9417920	Original		19 – Room 34	0733	0652
9417921	Original		20 – Room 25	0735	0654
9417922	Original	Yes	20 – Room 25	0739	0654
9417924	Original		21 – Room 27	0742	0656
9417925	Original		22 – Room 28	0743	0657
9417926	Original		23 – Room 26	0745	0658

Comments: Spike Sample =
Blank Sample = 9417923



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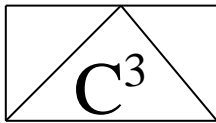
RADON AIR SAMPLE RECORD SHEET

SCHOOL: Bonanza Schools
ADDRESS: 31601 Mission Street
Bonanza, Oregon

DATE: 12-07-20/12-10-20
SAMPLER: Adam Patterson

SERIAL #	BUILDING	Duplicate	LOCATION	START TIME	STOP TIME
9417927	Original		24 – Room 24	0748	0659
9417928	Original		25 – Room 23	0750	0701
9417929	Original		26 – Room 22	0753	0703
9417930	Original		27 – Room 22	0755	0703
9417931	Original		28 – Room 21	0759	0705
9417932	Original		29 – Room Health	0801	0706
9417933	Original		30 – Room 17	0803	0708
9417934	Original	Yes	30 – Room 17	0803	0708
9417936	Original		31 – Room 17	0805	0710
9417937	Original		32 – Room 17	0807	0710
9417938	Original		33 – Concession	0810	0712
9417939	Original		34 – Weight Room	0811	0713
9417940	Portable		35 – Room 1	0815	0717
9417941	Shop		36 – Room 30	0818	0721
9417942	Shop		37 – Room 30	0819	0721
9417943	Portable		38 – Room 35	0823	0723
9417944	HS		39 – HS Office	0825	0725
9417945	HS		40 – Room 37	0827	0727
9417946	HS	Yes	40 – Room 37	0828	0729
9417948	HS		41 – Room 38	0830	0729
9417949	HS		42 – Room 39	0833	0731
9417950	HS		43 – Room 40	0835	0732
9417951	HS		44 – Room 54	0837	0734
9417952	HS		45 – Room 54	0838	0735
9417953	HS		46 – Room 52	0841	0736

Comments: **Spike Sample = 9417935**
Blank Sample = 9417947



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RADON AIR SAMPLE RECORD SHEET

SCHOOL: Bonanza Schools
ADDRESS: 31601 Mission Street
Bonanza, Oregon

DATE: 12-07-20/12-10-20
SAMPLER: Adam Patterson

SERIAL #	BUILDING	Duplicate	LOCATION	START TIME	STOP TIME
9417954	HS		47 – Room 53	0842	0738
9417955	HS		48 – Room 51	0845	0740
9417956	HS		49 – Room 50	0847	0742
9417957	HS		50 - Shop	0849	0744
9417958	HS	Yes	50 - Shop	0853	0744
9417959	HS		51 - Shop	0854	0744
9417960	HS		52 – Room 49	0856	0746
9417961	HS		53 – Room 49	0859	0747
9417962	HS		54 – Room 48	0902	0751
9417963	HS		55 – Room 47	0905	0753
9417964	HS		56 – Room 46	0907	0754
9417965	HS		57 – Room 45	0909	0756
9417966	HS		58 – Room 44	0911	0757
9417967	HS		59 – Room 43	0913	0758
9417968	HS		60 – Room 41	0915	0759
9417969	HS	Yes	60 – Room 41	0916	0759
9417972	HS		61 – Room 42	0918	0801

Comments: **Spike Sample = 9417970**
Blank Sample = 9417971

APPENDIX A

AIR CHEK LABORATORY ANALYSIS REPORT

December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20570102

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417901	8	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15
9417902	8	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15

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Radon test result report for:
BONANZA SCHOOL
20570100

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417903	7	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15
9417904	4	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15
9417905	3	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15
9417906	6	2020-12-07 @ 7:00 am	2020-12-10 @ 6:00 am	< 0.3	2020-12-15
9417907	5	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417908	12	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417909	9	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	0.5 ± 0.4	2020-12-15
9417910	13	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417911	13	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417912	10	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417913	11	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417914	14	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417915	30	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417916	32	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417917	33	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417918	29	2020-12-07 @ 7:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417919	29	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417920	34	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417921	25	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9417922	25	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417923	25	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417924	27	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417925	28	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417926	26	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417927	24	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417928	23	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417929	22	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417930	22	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417931	21	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417932	HEALTH	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417933	17	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417934	17	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417935	17	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	15.8 ± 1.0	2020-12-15
9417936	17	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.4	2020-12-15
9417937	17	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.6 ± 0.4	2020-12-15
9417938	CONCESSION	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.9 ± 0.4	2020-12-15
9417939	WEIGHT	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.7 ± 0.4	2020-12-15

December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20570100

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417940	1	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417941	30	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417942	30	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15

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December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20570101

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417943	35	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15

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December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20570100

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417944	HS OFFICE	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	0.8 ± 0.4	2020-12-15
9417945	37	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417946	37	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417947	37	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15
9417948	38	2020-12-07 @ 8:00 am	2020-12-10 @ 7:00 am	< 0.3	2020-12-15

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December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20571500

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417949	39	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417950	40	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	0.6 ± 0.4	2020-12-15
9417951	54	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	0.7 ± 0.4	2020-12-15
9417952	54	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417953	52	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	0.5 ± 0.4	2020-12-15
9417954	53	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417955	51	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417956	50	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15

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December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20571503

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417957	SHOP	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417958	SHOP	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417959	SHOP	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15

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December 24, 2020

**** LABORATORY ANALYSIS REPORT ****

Radon test result report for:
BONANZA SCHOOL
20571500

Kit #	Room Id	Started	Ended	pCi/L	Analyzed
9417960	49	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	0.6 ± 0.4	2020-12-15
9417961	49	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417962	48	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417963	47	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417964	46	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417965	45	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417966	44	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417967	43	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417968	41	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417969	41	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417970	41	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	16.7 ± 1.0	2020-12-15
9417971	41	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	< 0.3	2020-12-15
9417972	42	2020-12-07 @ 9:00 am	2020-12-10 @ 8:00 am	0.7 ± 0.4	2020-12-15

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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: ^{rem} 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 μ R/h Elevation = 820 ft

APPENDIX C

RADON SAMPLING LOCATION DIAGRAM

Bonanza Schools Map

