2022

Radon Program

Beaverton School District

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Beaverton School District Radon Program

1.0 INTRODUCTION

The Beaverton School District (BSD; also referred to herein as "district") is committed to identifying radon and minimizing its risk district-wide. Radon is a natural gas emitted from natural deposits of uranium in soil, which can move up through the soil allowing it to enter buildings in contact with the soil. Any building has the potential for elevated levels of radon and the only way to determine this level is to test the building.

In 2014, BSD embarked on the development of a comprehensive site-specific radon program that outlined a limited targeted radon sampling approach for all district schools and support facilities. The focus of this plan was to develop site-specific radon planning and training, detail a sample strategy and procedures, ensure result accuracy, outline communication channels, and provide a comprehensive sample result database.

The current version of the program herein has now been updated to incorporate all radon sample results through 2022 and in compliance with regulatory requirements. The objectives in this radon plan included a detailed approach to:

1. Conduct radon sampling in all schools and support facilities in all frequently occupied spaces in contact with the soil or located above a basement or a crawlspace.

2. Complete sampling of all required spaces throughout the district by January 1, 2021, with the exception of new BSD schools and schools undergoing major renovation,

3. Complete sampling for all district schools and support buildings and install required mitigation systems by February 2022, and

4. Report results to the BSD community and the Oregon Health Authority (OHA).

As of February 2022, BSD's sampling program is complete. Over 4,600 samples have been collected across all schools and support facilities within the district. **All sampled areas have been found to be below the EPA Action Level of 4.0** picocuries per liter of air (**piC/L) or have been controlled through active radon mitigation system.**

Moving forward, ORS 332.166-167 requires resampling of all spaces is required every 10 years. Radon Mitigation systems are recommended to be retested every 5 years. Retesting is also required after 'major renovations and alterations.'

As such, the new district Administrative Office will require radon sampling post occupancy winter of 2022-2023. Radon mitigation systems installed in 2021 at Fir Grove Elementary School (ES) and Raleigh Park ES will require sampling in 5 years or in 2026. The remaining sampled areas throughout the will require resampling within 10 years or beginning in 2027.

BSD is confident this radon program and sampling efforts have delivered, and will continue to deliver, statistically reliable radon results and effective communication to minimize the risk of radon the district students, teachers, and staff.

2.0 BSD RADON SAMPLING HISTORY AND SUMMARY

BSD has radon sample results dating back to 1989 but sampling data was incomplete. As such, in 2014 BSD embarked on the development of a comprehensive site-specific radon program that outlined a limited targeted radon sampling approach at all facilities which began in the winter of 2016. The current version of the program herein has now been updated to incorporate findings of the most recent targeted radon sample results and integrate new regulatory radon requirements.

To date BSD has collected 1350 samples at schools and support facilities throughout the district.

2.1 1989 RADON SAMPLING

BSD conducted a majority of our radon sampling in-house in 1989. A total of 932 short-term radon samples were collected within the district at that time. The Central Administrative Office and Maintenance building were also sampled. The other district support facilities were not sampled. A total of 36 initial samples reported values over the U.S. Environmental Protection Agency (EPA) Action Level for radon of 4.0 pCi/L. All 36 samples were retested and only three (3) samples were confirmed to contain radon concentrations over 4.0 pCi/L. Finally, those three (3) samples were retested a second time. Those retested high samples were reported from the following schools:

1. Aloha High School (HS), classroom J-1 – retest = 4.5 pCi/L. **Retest 2 = 4.8 pCi/L**,
2. Errol Hassell ES, classroom 312 – retest = 4.4 pCi/L. **Retest 2 = 7.4 pCi/L**,
3. Greenway ES, classroom 28 – retest = 6.2 pCi/L. **No 2nd retest conducted**.

2.2 2001 RADON SAMPLING

In 2001, limited follow-up sampling was conducted by ATC associates. Resampling was conducted at the three schools above, Aloha HS, Errol Hassell ES, and Greenway ES, as well as additional sampling at 10% of remaining schools. Four schools (10%) were randomly selected and consisted of Beaverton HS, Montclair ES, Mountain View Middle School (MS), and Ridgewood ES. At total of 54 samples were collected during this period. The resampling conducted of the 3 prior schools and new sampling conducted of the 4 additional schools showed non-detect radon concentrations with the exception of the following:

1. Beaverton HS, conference room 3 – test 1 = 5.2 pCi/L. Retest = 1.6 pCi/L (2.3 pCi/L duplicate)
2. Errol Hassell ES, class M-10 – test 1 = **4.7 pCi/L**. Retest = **4.7 pCi/L** (**5.1 pCi/L** duplicate)
3. Montclair ES, class M-100 – test 1= 4.3 pCi/L. Retest = 1.6 pCi/L (1.9 pCi/L duplicate)

An evaluation was conducted at classroom M-10 at Errol Hassel - the only confirmed high sample from 2001 sampling. It was determined that a crawlspace fan was negatively pressurizing the classroom space. The issue was corrected and the area was retested and determined to be below the EPA Action Level for radon of 4.0 pCi/L:

1. Errol Hassell ES, class M-10– retest after engineering control = 0.2 and 0.8 pCi/L.

At the conclusion the 2001 sampling, no resampled areas contained radon concentrations over the EPA Action Level of 4.0 pCi/L.

2.3 2014 Radon Program Development

In 2014, BSD's radon consultant, AMEC Foster-Wheeler (AMEC), conducted a thorough review of the district's existing legacy sample data. AMEC worked with the district to develop a comprehensive radon program. Analyzing the initial radon sample data, the following data gaps were identified:

1. New sites built or acquired since 1989 have no radon sample data.

2. New school additions completed after 1989 have no radon sample data.

3. Schools with detectable radon results should be resampled to verify non-detect status.

4. Sites with non-detectable radon results should be resampled to verify original sample results.

The above findings shaped a sampling strategy for the new district radon program. Program development also included a new radon database spreadsheet to organize the data set and allow for filtering functionality. The spreadsheet included the site name and type, area and date of sample, and all test and resample results and was designed to be expandable to accommodate new sample data. The spreadsheet may be found as Attachment 3 to this document.

Considering the existing data and current data gaps, AMEC along with BSD stakeholders agreed that the radon program would follow a targeted sample approach to fill radon data gaps. A prioritized targeted sample strategy would be the most effective way to quickly gather meaningful and current radon data throughout the district. The current listing of district sites were sorted and prioritized into four (4) prioritized categories, which included:

1. Sample all new district sites and areas not previously sampled. This includes newly built or newly acquired sites. This also includes additional square footage area resulting from significant renovation projects since 1989.

2. Re-sample all areas with any prior results *over* 4 pCi/L and re-sample a percentage of areas with any prior results *less than* 4 pCi/L.

3. Re-sample all areas, with long-term testing where appropriate, with any new radon concentration results over 4 pCi/L.

4. Re-sample remaining schools previously sampled and reported to no measurable radon levels. This would also include resampling of site areas that undergo significant renovation.

For each of these four (4) categories, a table was developed listing applicable sights and a minimum range of recommended representative samples were to be collected for each site based on square footage. Minimum recommended samples would range from 6-20 samples.

2.4 2015-2016 RADON SAMPLING

Targeted Sampling – All Sites

Following this newly developed radon sampling program plan, AMEC began district-wide targeted short-term radon sampling on in January 2016 and continued targeted sampling through May 2016.

Targeted sampling was conducted at every school and support facility. 423 short-term samples were collected district-wide. Sample distribution averaged six (6) samples per elementary school, 10 samples per middle school, and 12 samples per high school. Support facilities averaged six (6) samples collected.

The initial targeted radon sampling determined that only Ridgewood ES exceeded the U.S. EPA Action Level of 4.0 pi/C. All other district schools and facilities sampled were below EPA Action Level.

Initial testing conducted on March 15, 2016 at Ridgewood ES consisted of six (6) samples. Of those the gym sample was found to be over the EPA Action Level. A retest of the same six areas was conducted on April 4, 2016 and revealed gym radon levels below the Action Level and the 'C-Hall by classroom 114' was now well above the EPA Action Level. Initial test and retest results that exceeded the Action Level included the following:

1. **Gym – Initial test = 5.8 pCi/L.** Retest = 1.7 pCi/L, and
2. **C-Hall by classroom 114** - Initial test = 2.9 pCi/L. **Retest = 8.0 pCi/L.**

Due to the variability of the two sets of radon results, AMEC collected another twenty (20) samples throughout the school including the 6 original sample locations**. In this 3rd round of sampling conducted on May 16, 2016, none of the 20 samples collected were above the EPA Action Level.**

BSD's action plan for Ridgewood ES was to make adjustments to the school's Heating, Ventilation, and Air Conditioning (HVAC) ventilation system primarily by improving ventilation and ensure proper positive pressurization to the extent possible in preparation for complete sampling of all occupied spaces under Task 1 in the 2016-2017 year.

All radon results entered into a spreadsheet format made available on the district's Radon webpage as well as included as an attachment to the document.

2.5 2016-2017 RADON SAMPLING

Task 1 – Comprehensive Radon Sampling – 23 Sites – 1,085 Samples

Continuing with our radon sampling program plan, BSD moved forward with comprehensive sampling throughout the district over the 2016-2017 school year. Per the program, every school and support facility would be sampled for radon in **every occupied space with contact to the ground surface** which primarily meant basement and slab-on-grade level rooms. The comprehensive sampling protocol would be completed in three primary phases per our 5-year sampling plan presented in Section 3.0 below. Site selection over the three (3) primary phases was based on risk identified by the targeted sampling effort. Task 1 site selection criteria was defined as buildings with 'previous radon results near or above the 4.0 piC/L AL or contained new construction (new square feet) areas that had not previously been tested.' Task 1 sampling also included the new Timberland MS (now named Tumwater MS).

Initially BSD decided to involve Maintenance staff in the radon sample effort but later decided to enlist the radon consultant to conduct all sampling parameters for the project. PBS Engineering was contracted to place, collect, log and send radon samples to the accredited laboratory. PBS also ensured that all samples were valid and deployed the necessary quality control duplicates and blanks and entered results into a spreadsheet and in the Verdant database. This approach enabled the district to obtain the highest confidence in radon sample validity and results.

PBS began district-comprehensive radon sampling Task 1 in November 2017 and continued sampling through May 2018. 1,085 short-term samples were collected district-wide.

Task 1 sampling of 23 sites concluded that only Ridgewood ES contained radon results above the EPA Action level for radon of 4.0 pCi/L. All other district schools and facilities sampled were below the EPA Action Level.

Ridgewood ES testing took place in all occupied areas on February 12, 2017. **Of the 25 samples collected, areas with radon levels over the 4.0 PCi/L Action Level included:**

1. **Room 114 – initial test = 6.1 pCi/L**
2. **Room A104 – initial test = 4.3 pCi/L**
3. **Room A105 – initial test = 6.1 pCi/L**
4. **Room B114 – initial test = 4.3 pCi/L**
5. **Room B112 – initial test = 4.9 pCi/L**
6. **Room B108 – initial test = 5.4 pCi/L**

BSD's action plan for Ridgewood ES was to continue to make adjustments to the school's HVAC where possible and schedule sampling after an entirely new school-wide HVAC system was installed the Summer of 2018. HVAC project design began the summer of 2017 and was installed the summer of 2018. Re-sampling of Ridgewood is scheduled to occur during Task 3 in the 2018-2019 school year.

All radon results from Task 1 was entered into the Verdant system maintained by PBS for district use. Results were also entered into a spreadsheet made available on the district's Radon webpage as well as included as an attachment to the document.

2.6 2017-2018 RADON SAMPLING

Task 2 – Comprehensive Radon Sampling – 30 Sites – 1975 Samples

Continuing with BSD's radon program plan, the next comprehensive phase of radon sampling, Task 2, was comprised of 30 schools and support facilities sampled over the 2017-2018 school year. Task 2 of BSDs 5-year comprehensive sampling plan is presented in Section 3.0 below. Site selection criteria for Task 2 sampling was defined as buildings with 'previous radon results below the AL of 4.0 pCi/L.' Task 2 sampling included the new Sato ES, Vose ES, and Mountainside HS.

Similar to Task 1, BSD contracted radon consultant PBS Engineering to conduct all sampling parameters throughout the schools and support facilities. PBS placed, collected, logged and sent radon samples to the accredited laboratory and enter results in the Verdant database system. PBS also ensured that all samples were valid and deployed the necessary quality control duplicates and blanks.

PBS began district-comprehensive radon sampling Task 2 in February 2018 and continued targeted sampling through June 2018. 1,975 short-term samples were collected district-wide. Additionally, six (6) retests and five (5) long-term samples were collected during this phase.

Task 2 sampling of 30 sites concluded that specific areas of five (5) schools, presented below, contained radon results above the EPA Action Level for radon of 4.0 pCi/L. All other district schools and facilities sampled were below the EPA Action Level.

The following areas contained radon results above the EPA Action Level for radon of 4.0 pCi/L:

1. **Errol Hassel ES – Resource Room 1 - Initial test = 9.6 pCi/L and Duplicate test = 7.9 pCi/L. Retest = 4.7 pCi/L.**
2. **Montclair ES**
    a. **Gym Office - Initial test = 5.4 pCi/L.** Retest = 2.5 pCi/L.
    b. **Room M104 - Initial test = 4.0 pCi/L.** Retest = 1.8 pCi/L
3. **Raleigh Park ES – Custodial Office - Initial test = 5.5 pCi/L.** Retest = 3.7 pCi/L
4. **Cedar Park MS** – **Fitness Center - Initial test = 4.8 pCi/L.** Retest = 3.4 pCi/L

Based on these sample results above, long-term radon 90 day test kits were placed in the five (5) rooms at Cedar Park MS, Errol Hassell ES, Montclair ES, and Raleigh Park ES. The kits were placed in February 2018 and collected in June 2018. Long term results included:

1. **Errol Hassel ES – Resource Room 1 - 8.7 pCi/L.**
2. Montclair ES
    a. Gym Office – 3.6 pCi/L.
    b. Room M104 – 2.1 pCi/L
3. Raleigh Park ES – Custodial Office - 3.8 pCi/L
4. Cedar Park MS – Fitness Center - 2.4 pCi/L.

Each of the schools above have been notified and the Errol Hassel ES Resource Room has been vacated until a suitable solution is established. Adjustments to the HVAC systems at the four sites are scheduled and resampling of these areas will occur in Task 3 in the 2018-2019 school year.

Further, an additional sample was conducted at Fir Grove ES in classroom B112 upon request due to an initial test near the EPA Action Level of 4.0 pCi/L**.** A short-term retest was conducted in June 2018. The results included a **retest result of 7.9 pCi/L and duplicate test result of 8.4 pCi/L.** However, it was concluded that this sample was collected when the HVAC system serving the space was turned off. The HVAC override was not activated as directed and did not represent a

typical occupied condition. The action plan for this space was to increase fresh air ventilation and sample during occupancy in the 2018-2019 school year under Task 3.

At the end of Task 2 sampling, the overall action plan was to continue with Task 3 sampling which would include sampling all remaining schools and support facilities, a comprehensive resample Ridgewood ES, sample the new Hazeldale ES. Additionally, HVAC adjustments would be made to the extent possible to the 6 areas at the 5 schools identified above and resampled.

All radon results from Task 2 were entered into the Verdant system maintained by PBS for district use. Results were also entered into a spreadsheet made available on the district's Radon webpage as well as included as an attachment to the document.

2.7 2018-2019 RADON SAMPLING

Task 3 – Comprehensive Radon Sampling – 10 Sites - 517 Samples

Continuing with the implementation of BSD's radon program plan, Task 3 radon sampling was completed. This task was completed in alignment with BSDs 5-year comprehensive sampling plan is presented in Section 3.0 below.

Ten (10) schools were sampled over the 2018-19 school year. Site selection criteria for Task 3 sampling was defined as buildings with 'Sites with No Prior Detectable Radon.' Task 3 sampling included the new Hazeldale ES, resampling of Ridgewood ES, and follow-up resampling of five (5) Task 2 sites listed above.

For Task 3, BSD contracted radon consultant PBS Engineering to conduct all sampling parameters throughout the schools and support facilities. PBS placed, collected, logged and sent radon samples to the accredited laboratory and enter results in the Verdant database system. PBS also ensured that all samples were valid and deployed the necessary quality control duplicates and blanks.

PBS began district-comprehensive radon sampling Task 3 in January 2019 and continued targeted sampling until March 2019. 517 short-term samples were collected across the district.

The 10 schools not previously sampled had no areas above the above the EPA Action Level for radon of 4.0 pCi/L.

Resampling of Ridgewood ES after the major HVAC renovation also showed no areas above the above the EPA Action Level for radon of 4.0 pCi/L.

The only radon samples that were found to be above the EPA Action Level were additional samples conducted at Fir Grove ES in classroom B112. A **2nd retest result of 5.3 pCi/L in October 2018 and 3rd test result of 9.2 pCi/L was collected in February 2019.**

At the end of Task 3 sampling, the action plan moving forward was to consult with a radon specialist **to further evaluate the individual rooms at Errol Hassell ES, Fir Grove ES, Montclair ES, and Raleigh Park ES**. Additional HVAC adjustments were made to the extent possible to these areas prior to Task 4 evaluation.

All Task 3 radon results were entered into the Verdant system maintained by PBS for district use. Results were also entered into a spreadsheet made available on the district's Radon webpage as well as included as an attachment to the document.

2.8 2019-2020 RADON SAMPLING

Task 4 – Real-Time Radon Sampling and Mitigation Consulting – 4 Sites

Mitigation Consulting

Task 4 consisted of contracting Cascade Radon to conduct a series of additional real-time radon sampling at Errol Hassell ES, Fir Grove ES, Montclair ES, and Raleigh Park ES. A Continuous Radon Monitor (CRM) was used to collect radon concentrations once (1) per hour for four (4) continuous days. This test more accurately details radon levels at different times of the day, the influence of the HVAC system being turned off at night, and can calculate potential radon exposure during occupied hours.

1. **Errol Hassel ES – Resource Room 1:**
    a. October 21, 2019 – The CRM test revealed an average 4-day radon concentration average of **1.0 pCi/L** which is below the EPA Action Level. Further, the average radon concentration was **0.5 pCi/L** during the occupied time (7am – 4pm)**.** The test revealed a peak of 5.4 pCi/L a low of 0.0 pCi/L.

       The CRM test revealed higher radon concentrations room at night when the HVAC fans were minimal/off and lower concentrations when the space was purged when the HVAC fans where on in the morning prior to occupancy and during occupancy throughout the day. **Due to the low average result of 1.0 pCi/L and occupied average of 0.5 pCi/L, Cascade Radon stated that the space is permitted for occupancy but recommended additional follow-up sampling in the 2020-2021 school year.**

2. **Fir Grove ES – Speech Therapy Office Room B112:**
    a. October 21, 2019 – The CRM test revealed an average occupied radon concentration average of **2.4 pCi/L** which is below the EPA Action Level. Further, the average radon concentration was **1.8 pCi/L** during the occupied time (7am – 4pm). The test revealed a peak of 7.9 pCi/L a low of 0.0 pCi/L.

    b. The CRM test revealed a similar pattern of higher radon concentrations room at night when the HVAC fans were minimal/off and lower concentrations when HVAC fans where on during the day. **However, due to the average occupied concentrations being close to 2.0 pCi/L and HVAC adjustments already implemented, Cascade Radon recommended installing radon mitigation system.**

    c. Cascade Radon was contracted to install a temporary radon mitigation system in Room B112 and determine its effectiveness. The system was installed on July 27, 2020. Post installation test results revealed the following:

        i. November 12, 2020 - The CRM test revealed an average occupied radon concentration average of **1.5 pCi/L** which is below the EPA Action Level. **Cascade Radon stated that the space is permitted for occupancy** and recommends the permanent radon system to be installed which is scheduled be installed in the first quarter of 2021.

3. **Montclair ES**
    a. **Gym Office:**
        i. March 13, 2019 - The CRM test revealed an average occupied radon concentration average of **2.5 pCi/L** which is below the EPA Action Level. Further, the average radon concentration was **0.4 pCi/L** during the occupied time (7am – 4pm). The test revealed a peak of 12.2 pCi/L a low of 0.0 pCi/L.

        Similarly, the CRM test revealed higher radon concentrations room at night when the HVAC fans were minimal/off and lower concentrations when the space was purged when the HVAC fans where on in the morning prior to occupancy and during occupancy throughout the day.

    b. **Room M104:**
        i. March 13, 2019 - The CRM test revealed an average occupied radon concentration average of **1.1 pCi/L** which is below the EPA Action Level.

Further, the average adon concentration was **0.2 pCi/L** during the occupied time (7am – 4pm) r**.** The test revealed a peak of 4.0 pCi/L a low of 0.0 pCi/L.

4. **Raleigh Park ES – Custodial Office:**
    a. December 20, 2019 - The CRM test revealed an average occupied radon concentration average of **5.7 pCi/L which is above the EPA Action Level**. Further, the average radon concentration was **5.3 pCi/L** during the occupied time (7am – 4pm). The test revealed a peak of 16.6 pCi/L a low of 0.3 pCi/L.

    b. Cascade Radon was contracted to install a temporary radon mitigation system in Room B112 and determine its effectiveness. The system was installed on September 27, 2020. Post installation test results revealed the following:

        i. November 13, 2020 - The CRM test revealed an average occupied radon concentration average of **1.1 pCi/L** which is below the EPA Action Level. **Cascade Radon stated that the space is permitted for occupancy** and recommends the permanent radon system to be installed which is scheduled to be installed in the first quarter of 2021.

As of December 2020, BSD's initial program sampling program of implementing Tasks 1-5 was complete. To date, over 4,600 samples have been collected across 58 buildings. New school sampling remains at Tumwater MS, William Walker ES and the new Arts and Communication Magnet Academy (ACMA) schools as well as post-occupancy sampling along with Five Oaks MS and the International School of Beaverton (ISB) after HVAC renovations were completed.

Of all BSD areas sampled only two rooms – Fir Grove ES B112 special education office at and the Raleigh Park custodial office require radon mitigation systems. Temporary mitigation systems were installed in March 2020 and August 2020 respectively. Those systems have tested well and plans for permanent system installation are currently being proposed. Montclair and Errol Hassel will be retested during occupancy post COVID.

Per the Oregon Health Authority Rule, resampling areas with radon mitigation systems is annually and all other areas with radon levels below the EPA Action Levels are recommended to be resampled every 5-years.

2.9 2021-2022 RADON SAMPLING

Task 5 – Radon Sampling – 5 Remaining Sites + Mitigation System Installation – 332 Samples

Finalizing BSD's radon program plan, Task 5 radon sampling was completed. This task as added to our BSDs 5-year comprehensive sampling plan is presented in Section 3.0 below.

Five (5) remaining schools were sampled over the 2021-2022 school year. These last sites included newly constructed schools and schools that underwent significant renovation. These sites included new schools Tumwater MS, William Walker ES, and ACMA ES and renovated sites Five Oaks MS and ISB.

Similar to prior tasks, BSD contracted radon consultant PBS Engineering to conduct all sampling parameters throughout the schools and support facilities. PBS placed, collected, logged and sent radon samples to the accredited laboratory and enter results in the Verdant database system. PBS also ensured that all samples were valid and deployed the necessary quality control duplicates and blanks.

PBS completed district-comprehensive radon sampling under Task 5 in January 2022. 1,594 short-term samples were collected.

The remaining 5 schools had no areas above the above the EPA Action Level for radon of 4.0 pCi/L.

Additionally, during this task period Cascade Radon moved to install permanent radon mitigation systems at Fir Grove Room B112 and Raleigh Park Custodial Office in May and June, 2021, respectively. **Follow-up radon sampling of these radon mitigation system areas revealed radon concentrations well below the EPA Action Level for radon of 4.0 pCi/L.**

2.10 RADON TRAINING

As part of BSD's initial radon program, an initial radon awareness training was conducted by AMEC to all district school custodians at the district's annual All Hands Training on June 21, 2016. AMEC touched on what radon is, the entry routes of radon, when and where to sample and under what conditions, and how to sample for radon using short-term kits. The radon slide presentation is available to the district to assist in internal training of key sampling personnel and is provided as Attachment 4. BSD has suspended further custodial training due to the decision to have a consultant execute the entire radon sampling program. Custodians or other BSD employees will not be involved or responsible for any radon sampling. BSD will provide necessary awareness training to key personnel as necessary.

2.11 OREGON RADON LEGISLATION

The Oregon Legislature passed HB 2931 in the Spring 2015 session which later became Oregon Revised Statute (ORS) 332.166-167. Copies of these documents are provided as Appendix A.

BSD's radon program was initially developed to be flexible enough to accommodate this anticipated legislation.

Additionally, as directed under this statue, OHA has produced a guide to assist Oregon school districts to accurately measure their school buildings for elevated radon. The final document version 1.0 - 2016 entitled '*Protocol for Elevated Radon in Schools*' takes into account current national guidelines for measuring radon in schools and large building. It is based on radon school measurement plans from other states. This guidance document is also included as Appendix B.

The current radon program explains in detail how the district plans on complying with the new regulatory requirements in Section 3.0 below.

BSD will remain cognizant of any new radon laws and incorporate those requirements into our program on annual basis.

3.0 SAMPLING STRATEGY

BSD's current radon sampling strategy and plan integrates current radon sample data results through 2018, radon requirements under ORS 332.166-167, and the OHA radon sampling guidance document.

As such, BSD's primary program goals are as follows:

1. Continue to provide radon testing in all schools and support facilities in all frequently occupied rooms in contact with the ground or located above a basement or a crawlspace on or before January 1, 2021.

2. Radon testing results will be provided to the district school board and made readily available to parents, guardians, students, school employees, school volunteers, administrators and community representatives on the school district's website. Radon results will also be forwarded to OHA for posting on their website.

3. Provide radon testing in all schools and support facilities at least once every 10 years thereafter.

3.1 5-YR SAMPLING STRATEGY OVERVIEW

Targeted sample results available for all BSD schools and facilities were utilized to develop a comprehensive sample strategy as the focus shifted to sampling schools and facilities in their entirety until all required interior spaces are sampled. Sample priority given for schools and support facilities fell into the following 3 primary task groups largely based on known risk:

1. Task 1 - Re-sampling of Ridgewood elementary school based on 2015/2016 results. Sample district schools and support facilities that are **newly acquired or contain additional square footage** since 1989 and any newly built facilities,

2. Task 2 - Sampling district schools and support facilities with **any prior** results *near or over* 4 pCi/L and any newly built facilities,

3. Task 3 - Sampling remaining district sites where all results have been considerably less than 4 pCi/L or non-detect and and any newly built facilities, and

4. Task 4 - Sampling any remaining required spaces and/or resampling spaces where required. Task 5 will include conducting final radon program updates based on final sample results and any reporting requirements.

5. Task 5 – Sampling of BSD remaining new schools and schools with major HVAC renovation completed.

Note that if any site is found to have results over the EPA Action Level, the site will be resampled immediately within the same sample season (October – March). If long-term testing is required and it is late in the sample season, sampling may be scheduled for the beginning of the next sample year.

Three (3) tables have been developed detailing each of the first 3 primary tasks and are included as Attachment 1 to this program document. Table 1 below provides a summary of this sample effort, timing, and cost over the sample program period.

TABLE 1 – BSD RADON SAMPLING PLAN OVERVIEW WITH ESTIMATED COSTS

Task	Task Description	Timing	Short-Term Samples Collected (1)	Cost to the District
Task 1	Table 1 - New schools and support facilities and sites with additions since 1989 - 21 sites. Task 1 includes additional sampling at Ridgewood ES and new Timberland MS	October 2016 – March 2017 **COMPLETED**	1085	$38,628
Task 2	Table 2 – Schools and support facilities with any prior radon result near or over EPA Action Level – 27 sites including 3 new schools.	October 2017 – March 2018 **COMPLETED**	1975	$49,470
Task 3	Table 3 - Schools and support facilities with all prior radon results under EPA Action Level – 8 sites including new Hazeldale ES and resampling Ridgewood ES.	October 2018 – March 2019 **COMPLETED**	517	$22,373
Task 4	Additional testing of areas above the EPA AL and final installation of necessary radon mitigation system(s)	April 2019-October 2021 **COMPLETED**	NA	$23,150
Task 5	Sampling 5 remaining schools that were either new schools or undergoing major renovation recently completed. Five Oaks MS, ISB, Tumwater MS, William Walker ES, ACMA.	October 2021 – March 2022 **COMPLETED**	332	$11,025
Task 6	Testing of the new District Administrative Office (2023), 5-yr testing of radon mitigation systems (2026), and 10-yr annual retesting (beginning 2027).	Beginning Winter 2023	NA	TBD
Total Sample Count and Cost			3,909	$114,646

(1) Sample count includes estimated occupied basement and first floor with contact with the ground and all rooms over a crawlspace including portable classrooms. Sample counts also include sample blanks, duplicates, and spike samples for QA/QC.

4.0 BSD SAMPLING PLAN OVERVIEW

To execute the radon strategy outlined in Section 3.0, the following sampling plan has been developed:

1. The BSD Radon Program shall be administered by the BSD Maintenance Department with all sampling conducted from the qualified radon consultant.

2. Radon sampling will occur in all frequently occupied spaces in contact with the soil or located above a basement or a crawlspace and will occur simultaneously per site.

3. The radon consultant will be tasked with developing a detailed annual district-wide sampling plan that complies with the sample strategy defined in Section 3.0 above.

4. The radon consultant will be tasked with for developing a site-specific sampling plan for each site that must be approved by BSD. The plan will include:

    a. Room/ area listing with sample count per area,

    b. A sample test kit placement log to record specific location, date, and time information,

    c. Facility map indicating sample areas, and

    d. Consultant contact information.

5. BSD will be responsible for providing a brief radon tutorial to the site administrator(s) prior to conducting the survey and sampling.

6. The radon consultant will conduct radon sampling procedures in accordance with Section 5.0 below and will utilize the '*Radon Test Placement Protocol Checklist'* provided as Attachment 2.

7. The radon consultant will also be responsible for sample pick up, initial sample info validation, and blank/duplicate/spike sample verification while on-site.

8. The radon consultant will be responsible for sample chain-of-custody completion, enter all sample information into the radon laboratory's sample analysis spreadsheet, and shipment of all radon samples to the accredited laboratory.

9. All sample results from the radon laboratory will be sent directly to the radon consultant for final sample data validation and enter all results into BSD's Verdant Web-hosted data management system.

10. The radon consultant will notify BSD of any radon results over the EPA Action Level within 24-hrs of sample result receipt from the laboratory.

11. Any sample results that are over the EPA Action Level will be re-sampled per Section 5.4. If results are verified over the EPA Action Level, engineering controls will be pursued to the extent possible prior to mitigation system discussion.

12. The radon consultant will prepare a detailed report on an annual basis that summarizes findings, conclusions, and recommendations.

13. BSD will be responsible for forwarding annual sample results to the OHA in the required format on an annual basis or at a frequency required by OHA.

14. The district along with the radon consultant will collectively review and update the radon plan minimally on an annual basis to ensure regulatory compliance is met and integrate any new radon legislation. Estimated radon budgeting projections will also be adjusted on an annual basis.

5.0 BSD SAMPLING PROCEDURE GUIDELINES

Sampling methodology has been developed to comply with the OHA Radon Measurement Protocol for Oregon Schools 'Testing for Elevated Radon in Public Schools' guidance document included as Appendix B.

NOTE: Radon sampling may only be conducted by BSD personnel who have received the appropriate level of radon training or under the supervision of the radon consultant or trained BSD staff member.

5.1 GENERAL SAMPLING RULES

Radon sampling procedures shall include the following:

1. All schools and facilities should be notified well in advance of sampling at their facilities. Staff should be given the radon communication memo provided in Attachment 2 as well as a firm sample period date.

2. Radon sampling should not be conducted if the school or support facility is planning remodeling; making changes in the heating, ventilating and air conditioning system; or performing other modifications that may influence the radon concentration during the measurement period.

3. The sample area should be closed, with all windows and external doors shut (except for normal entrance and exit) for at least 12 hours prior to and during the sampling period. For this reason, measurements should be made during the winter whenever possible.

4. Sites shall only be tested for radon during periods when the HVAC system is operating as it does normally and during the time that students and teachers are normally present.

5. All radon samples should be collected in the colder/winter months – October 1- March 31.

6. Do not conduct short-term measurements (2-5 days) during severe storms or period of high winds.

7. Initial measurements should be short-term measurements of 2-7 days, and should be made in all frequently occupied rooms in contact with the soil, whether the contact is slab-on-grade, a basement, a room above a crawlspace or any combination.

8. All radon samples should be deployed in a school or facility on the same day.

9. The radon sample must not be disturbed during the measurement period.

10. Frequently occupied rooms include classrooms, offices, conference rooms, computer rooms, gymnasiums, auditoriums, cafeterias and break rooms.

11. Do not test storage rooms, kitchens, bathrooms, stairways, hallways, or elevator shafts.

12. A minimum of one detector test kit must be placed for up to every 2000 square feet of open floor area. For example, a 3500 square foot gymnasium would require two test kits.

13. In addition to the initial radon sample kits, the radon consultant will also supply the required Quality Assurance (QA) samples to be collected in accordance with Section 5.3.

5.2 SAMPLE PLACEMENT AND DURATION

Sample placement and duration procedures described here are summarized from the 'Radon Test Placement Protocol Checklist' provided as Attachment B.

1. Prior to opening the radon sample read all instructions that come with the specific radon sample kit and make sure all fields are properly filled out including but not limited to: (1) sample area, (2) sample time on, (3) sample serial number, (4) any relevant room conditions.

2. When collecting the radon sample be sure to note the sample stop time.

    a. **The most important information is the day and time the sample was opened and the day and time the sample was closed.**

    b. Be sure at end of sampling that the sample is securely closed.

3. Test kits should be placed:

    a. Where they are least likely to be disturbed or covered up,

    b. At least 3 feet from doors, windows to outside or ventilation ducts,

    c. At least one foot from exterior walls,

    d. At least 20 inches to six feet from floor (as close to the breathing zone as possible), and,

e. About every 2,000 square feet for large spaces (e.g., a 3500 square foot gymnasium would require two test kits)

4. Test kits must **NOT** be placed:

   a. Near drafts resulting from heating, ventilating vents, air conditioning vents, fans, doors, and windows.

   b. In direct sunlight

   c. In areas of high humidity such as bathrooms, kitchens, laundry rooms, etc.

   d. Where they may be disturbed at any time during the test.

5. The sample should be deployed for a 3 to 5 day measurement period – minimum 48 hrs and maximum 7 days. The sample period usually sampling will occur on Monday morning and conclude on Thursday morning.

6. When retrieving the radon sample, care should be taken to inspect the device for tampering during the sample period. Any sample device displaying any signs of tampering should be voided.

7. Confirm with Maintenance and the radon consultant for sample pick-up for lab shipping to occur the same day samples are collected.

8. The radon sample must be sent to the laboratory as soon as possible, preferably within a few days following exposure termination.

5.3 QUALITY ASSURANCE/ CONTROL

The following Quality Assurance/ Quality Control (QA/QC) parameters will be integrated into the radon sampling plan. The radon consultant will be responsible for including the required number duplicates, blank, and spike samples for each site. Each site should have a minimum of one duplicate and one blank.

1. **Duplicates:** Duplicates provide an indication of the precision of the measurement. Duplicates are test kits that are placed in the same location alongside the kits used as detectors for the same measurement period.

a. The number of duplicates should be 10 percent of the rooms to be tested at each site.

b. A minimum of one duplicate per site is needed.

2. **Blanks:** Blanks can be used to determine whether the manufacturing, shipping, storage, or processing of the test kit has affected the accuracy of the measurements. They are called blanks because when placed alongside detectors, that are opened, but then immediately resealed. As a result, blanks should have results at or close to 0.0 pCi/L.

    a. The number of blanks should be 5 percent of the rooms to be tested at a school site. A minimum of one blank per building is needed.

3. **Spikes:** Spikes evaluate how accurately the detectors supplied by the laboratory measure radon and the accuracy of the lab's sample processing.

    a. The number of spikes should be 3 percent of the rooms to be tested at a school site.

The radon consultant will calculate how many detector kits are needed. This number equals the number of "regular" rooms that are to be measured plus those kits required for "larger" rooms (2000 sq. ft. or larger). [Larger rooms need one test kit per 2000 sq. ft. or portion thereof, so a 3500 sq. ft. gymnasium needs two detector kits.] Test kit percentages for QA are based on the number of rooms to be tested, NOT the number of detector kits to be used.

After determining the number of test kits (detectors, blanks, duplicates & spikes) needed for initial measurement of school site(s), kits should be purchased from one manufacturer (and be from one lot). It is most cost effective to purchase in bulk.

Once the kits are received, Team staff should randomly draw the kits needed for spiking (the 3%) from the boxes. The serial numbers of the kits should be recorded, noted as the kits being reserved for spike testing, and set aside.

5.4 RESAMPLING PROCEDURES

Areas to be resampled will decided by the district as recommended by the radon consultant. Conditions that trigger resampling will generally include the following information.

If the results of a radon screening test in any frequently occupied room are found to be 4.0 pCi/L or greater, follow-up measurements should be conducted. EPA and OHA recommend that follow-

up testing of rooms 4.0 pCi/L or greater be conducted before any mitigation decisions are made. Follow-up testing should start quickly, ideally within one month of receiving initial test results.

Based on the results of the initial short-term test for a room, the following steps should be conducted:

- If the result is less than 2.0 pCi/L, ORS 332.166-167 requires school districts to test again every ten years.
- If the result is between 2.0 pCi/L and 4.0 pCi/L, consider fixing (lowering) the radon in that room.
- If the result is from 4.0 pCi/L to 8.0 pCi/L, perform a follow-up measurement of that room using a Long-Term test. This should be conducted over as much of a nine-month school year as possible, when the room's likely to be occupied. If that result is equal to or greater than 4.0 pCi/L, the radon in the room should be fixed (lowered).
- If the initial test result is equal to or greater than 8.0 pCi/L, conduct a second Short-Term test and average its result with the result of the initial Short-Term test. If the average result of the two Short-Term tests is equal to or greater than 4.0 pCi/L, then radon in the room should be fixed (lowered).

All follow-up measurements in a school building should be conducted simultaneously. Follow-up measurements should be made in the same locations and under the same conditions as the initial measurements (to the extent possible, including similar seasonal conditions and especially HVAC system operation). If follow-up measurements using short-term tests are done, be sure to maintain closed-building conditions. This will ensure that the two results are as comparable as possible.

The higher the initial short-term test result, the more certain you can be that a short-term test should be used rather than a long-term follow-up test. In general, the higher the initial measurement, the greater the urgency to do a follow-up test as soon as possible. For example, if the initial short-term measurement for a room is several times the radon action level (e.g., at or above 8.0 pCi/L or higher), a short-term follow-up measurement should be taken immediately.

6.0 MITIGATION GUIDELINES

In the event of a confirmed radon result over the EPA Action Level of 4.0 pCi/L, the following procedures will be followed:

- The sample(s) shall be validated by the radon consultant.
- The same area(s) will be retested in accordance with the OHA guidance document.
- After retesting the sample area shall be assessed by the appropriate district personnel and/or radon consultant for:
    - Adequate ventilation or pressurization issues - particularly common in basement rooms.
    - Evidence of structural damage to the slab or the wall slab juncture and/or obvious repairs areas, and
- The area may be resampled again after engineering controls have been administered.
- If short-term sample results continue to be above the EPA Action Level, long-term samples will be deployed.
- The district will, in a timely manner, consider mitigation systems if long-term sample results remain high and all other engineering controls have been exhausted.

7.0 RADON REPORTING AND DISTRIBUTION

ORS 332.166-167 requires that school districts make all test results available: to the district's school board; the Oregon Health Authority (to post on its website), and readily available to parents, guardians, students, school employees, school volunteers, administrators and community representatives at the school office, district office or on a website for the school or school district.

BEAVERTON SCHOOL DISTRICT

ATTACHMENTS

BEAVERTON SCHOOL DISTRICT

Attachment 1

Radon Sample Site Tables

BEAVERTON SCHOOL DISTRICT

Attachment 2

Radon Test Placement Protocol Checklist and Communication Memo

BEAVERTON SCHOOL DISTRICT

Attachment 3

BSD Radon Sample Data

APPENDICIES

BEAVERTON SCHOOL DISTRICT

Appendix A

Oregon Legislative Rule HB 2931 and ORS 332.166-167

BEAVERTON SCHOOL DISTRICT

Appendix B

Oregon Health Authority '*Protocol for Elevated Radon in Schools*'