Jefferson School District 14J
Radon Testing, Measurement and Mitigation Plan

The 2015 Legislature passed House Bill (HB) 2931 so that elevated radon levels in Oregon schools would be known. House Bill 2931 later became Oregon Revised Statute (ORS) 332.166-167. As directed by this statute, all school districts in Oregon must develop a plan to accurately measure school buildings for elevated radon levels. Under the statute, school districts must submit a plan to Oregon Health Authority (OHA) by September 1, 2016. Per ORS 332.166-167, actual testing of schools must be done on or before January 1, 2021 and the testing results sent to OHA and posted on the school or school district's website.

This plan will develop the protocols necessary for compliance. OHA's Testing for Elevated Radon in Oregon Schools, specifically Appendices A and D will be used to guide this effort. Below is the plan developed for the Jefferson School District.

Per ORS 332.166-167, School Radon Measurement Teams (i.e. personnel appointed to measure a school site for elevated radon) must, at a minimum, conduct initial measurements in all frequently occupied rooms in contact with the soil or located above a basement or a crawlspace. Testing will occur in all frequently occupied spaces simultaneously per school site. Examples include: offices, classrooms, conference rooms, gyms, auditoriums, cafeterias and break rooms. A minimum of one detector for every 2,000 sq. ft. of open floor space or portion thereof is required. United States Environmental Protection Agency (USEPA) studies indicate that radon levels on upper floors are not likely to exceed the levels found in ground-contact rooms. Testing rooms on the ground-contact floor or above unoccupied basements or crawlspaces is sufficient to determine if radon is a problem in a school. Areas such as rest rooms, hallways, stairwells, elevator shafts, utility closets, kitchens storage closets do not need to be tested.

Initial and follow-up testing, as needed, will use passive test devices. Active devices (electrically powered, continuous radon monitors) may be used in follow-up testing of locations, if needed, where it is important to determine that radon levels vary according to the time of day. Because testing under closed conditions is important to obtain meaningful results from short-term tests, the District will schedule testing during the coldest months of the year. "Closed building conditions" are defined as keeping all windows closed, keeping doors closed except for normal entry and exit, and not operating fans or other machines which bring in air from outside. Fans that are part of a radon-reduction system or small exhaust fans operating for only short periods of time may run during the test. Testing will occur between October and March in any given school year. Short term testing will be used with passive test kits will be used in "closed building conditions." Test kits will be placed during weekdays with HVAC (heating, ventilation, air conditioning) systems operating as they do normally. The following is a detailed protocol instruction checklist:

1. A Test Kit Placement Log and a Test Kit Location Floor Plan will be prepared for each school in which radon measurements are made. Schools will use their emergency/fire escape plan as a template. Test kit location will be accurately recorded on both a Log and Floor Plan. Test kits or testing services must meet the current requirements of the national certifying organizations, National Radon Proficiency Program (NRPP, www.nrpp.info) or the National Radon Safety Board (NRSB, www.nrsb.org). Testing must be done following the directions on the test kit.

2. Per ORS 332.166-167, school radon measurement teams must, at a minimum, conduct initial measurements in all frequently occupied rooms in contact with the soil or located above a basement or a crawlspace. Room examples include offices, classrooms, conference rooms, gyms, auditoriums, cafeterias and break rooms.

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3. The number of test kits used to measure radon (detectors) must be determined by counting the number of appropriate rooms. One detector kit is used for each room that is 2,000 square feet or less. Additional test kits are needed for larger rooms.

4. Added to this number will be the test kits needed for Quality Assurance purposes.

5. Test kits will be placed in all rooms in contact with the soil or located above a basement or crawlspace that are frequently occupied by students and school staff.

6. Testing will occur during the time that students and teachers are normally present (during weekdays).

7. In addition to placing detectors, additional test kits will be provided to serve as quality assurance measures (duplicate, blank, and spike measurements). Quality Assurance procedures will be conducted as described in OHA's Testing for Elevated Radon in Oregon Schools.

8. All test kits placed in the school site (detectors, duplicates, and blanks) must be noted on the Device Placement Log and Floor Plan by their serial number.

9. Test kits should be placed.

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

    b. At least three 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.

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

Along with the five-item placement protocol above, School Radon Measurement Teams can simply place the test kit on the teacher's desk or up on a bookshelf, out of the way of students. To prevent tampering, kits may be suspended from a wall or ceiling (using string and thumb-tack/tape). If they are suspended, they should be 20 inches to 6 feet above the floor, at least 1 foot below the ceiling.

10. 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

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11. Testing with short-term test kits must be used under closed conditions (closed windows/doors except for normal exit/entry).

    a. Closed conditions: Short-term tests should be made under closed conditions in order to obtain more representative and reproducible results. Open windows and doors permit the movement of outdoor air into a room. When closed conditions in a room are not maintained during testing, the subsequent dilution of radon gas by outdoor air may produce a measurement result that falls below the action level in a room that actually has a potential for an elevated radon level. Schools shall only be tested for radon during periods when the HVAC system is operating as it does normally.

    b. All external doors should be closed except for normal use – structural and weatherization defects need to be repaired prior to testing.

    c. Closed conditions must be verified when placing and retrieving test kits.

12. Short-term test kits will be placed during colder months (October through March).

    a. Colder months: Because testing under closed conditions is important to obtain meaningful results from short-term tests, the District will schedule testing during the coldest months of the year. During these months, windows and exterior doors are more likely to be closed. In addition, the heating system is more likely to be operating. This usually results in the reduced intake of outside air. Moreover, studies of seasonal variations of radon measurements in schools found that short-term measurements may more likely reflect the average radon level in a room for the school year when taken during the winter heating season.

    b. The District will check and document local weather forecasts prior to placing test kits. Do not conduct short-term measurements (2-5 days) during severe storms or period of high winds. The definition of severe storm by the National Weather Service is one that generates winds of 58 mph and/or ¾ inch diameter hail and may produce tornadoes.

13. Test Kits will be placed during weekdays with HVAC (heating, ventilation, air conditioning) systems operating as they do normally.

Suggested timeline:

Monday morning – Place kits (detectors/duplicates/blanks) per Test Kit Placement Log created for school. Record data, as needed, on Log.

Thursday morning – Pick up kits, record as needed, ship with (previously requested & received) spiked test kits to Radon Measurement Laboratory.

a. Air conditioning systems that recycle interior air may be operated.

b. Window air conditioning units may be operated in a re-circulating mode, but must be greater than 20 feet from the test kit.

c. Ceiling fans, portable humidifiers, dehumidifiers and air filters must be more than 20 feet from the test kit.

d. Portable window fans should be removed or sealed in place.

e. Fireplaces or combustion appliances (except for water heaters/cooking appliances) may not be used unless they are the primary source of heat for the building.

f. If radon mitigation systems are in place in the school, they should be functioning.

14. The District will not conduct initial measurements under the following conditions:

a. During abnormal weather or barometric conditions (e.g., storms and high winds). If major weather or barometric changes are expected, it is recommended that the 2 to 5-day testing be postponed. USEPA studies show that barometric changes affect indoor radon concentrations. For example, radon concentrations can increase with a sudden drop in barometric pressure associated with storms.

b. During structural changes to a school building and/or the renovation of the building's envelope or replacement of the HVAC system

15. After receiving the results of the initial testing, School Radon Measurement Teams will follow the "Interpreting initial results" section of the OHA's Testing for Elevated Radon in Oregon Schools.

Follow-up Measurements

Follow-up testing (in rooms with initial short-term measurement of 4.0 pCi/L or higher) should start within one month after receiving the initial test results. Follow-up testing must be made in the same location in a room. When conducting follow-up testing using short-term methods will be done in the same conditions as the initial measurement. Follow-up testing using passive short-term test kits should follow the same Quality Assurance procedures and requirements (i.e. percentages of duplicates/blanks/spikes), including quality assurance calculations. Follow directions under Radon Test Placement Strategy and Protocol Checklist and Test Kit Placement again.

Report of Results 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.

US EPA, OHA Oregon Radon Awareness Program, and numerous non-governmental groups recommend that the school district take action to reduce the radon level in those rooms where the average of the initial and follow-up short-term kit results OR the result of the long-term kit used in follow-up is 4.0 pCi/L or more.

Initial testing will be conducted in accordance with ORS 332.166-167 before January 1, 2021. Because buildings age and ground beneath them settles, radon entry may increase due to cracks in the foundation.

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For that reason, ORS 332.166-167 requires that schools be tested once every 10 years regardless of initial testing results or whether mitigation was done.

Suggested times, for retesting, in addition to that required under ORS 332.166-167, are as follows:

1. Current national guidelines (ANSI/AARST, 2014) recommend that school buildings be re-tested every five years.

2. If radon mitigation measures have been implemented in a school, retest these systems as a periodic check to ensure that the radon mitigation measures are working. EPA does not provide a specific interval, but OHA recommends that schools with radon mitigation measures retest every 5 years.

3. Retest after major renovations to the structure of a school building or after major alterations to a school's HVAC system. These renovations and alterations may increase radon levels within a school building.

4. If major renovations to the structure of a school building or major alterations to a school's HVAC system are planned, retest the school before initiating the renovation. If elevated radon is present, radon-resistant techniques can be included as part of the renovation.

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GLOSSARY

Radon - A gaseous radioactive decay product of radium.

Blanks - Measurements made by analyzing unexposed (closed) detectors that accompanied exposed detectors to the field. The School District use of blanks is to assess any change in analysis result caused by exposure other than in the environment to be measured. Background levels may be due to leakage of radon into the detector, detector response to gamma radiation, or other causes.

Closed-Building Conditions - Means keeping all windows closed, keeping doors closed except for normal entry and exit, and not operating fans or other machines which bring in air from outside. Fans that are part of a radon-reduction system or small exhaust fans operating for only short periods of time may run during the test.

Duplicates - Duplicate measurements provide a check on the precision of the measurement result and allow the user to make an estimate of the relative precision. Large precision errors may be caused by detector manufacture or improper data transcription or handling by suppliers, laboratories, or technicians performing placements. Precision error can be an important component of the overall error. The precision of duplicate measurements are monitored and recorded as quality records.

Spikes – Measurements used to assess the accuracy of a lab analysis and/or how accurately detectors supplied by a laboratory (i.e. test kit manufacturer) measure radon. “Spikes” are test kits that have been exposed to a known concentration of radon in a chamber approved by the National Radon Proficiency Program (NRPP) or National Radon Safety Board (NRSB). The process for completing this aspect of a radon measurement effort’s Quality Assurance/Quality Control plan is laid out in the Radon Test Placement Strategy and Protocol Checklist below.

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Appendix A: Test Kit Placement Guide

Once the number of test kits is determined, they will be placed in the frequently-occupied rooms as identified in the "What Rooms Should Be Tested?" section above.

a. Be sure to check these items before placing the radon test kits:

- ☐ Closed building conditions have been maintained in the building for 12 hours.
- ☐ HVAC system is operating as it normally would when students and faculty are present.
- ☐ Testing is being done during a time that students and faculty are present.

b. As detectors are placed in the rooms determined during section 1, thorough and accurate data needs to be recorded on the device log and floor plan (see sample below).

Protocol for all test kits include the following; be sure that each detector placed is:

- ☐ in a location where it will be undisturbed
- ☐ out of direct sunlight
- ☐ three feet from all doors and windows
- ☐ four inches from all other objects
- ☐ at least 1 foot from all exterior walls
- ☐ at least 20 inches to 6 feet from the floor
- ☐ out of direct air flow from vents
- ☐ four feet from heat source

To protocol above, School Measurement Teams in other states simply place the test kit on the teacher's desk or up (out of the way of students) on a bookshelf.

c. Specific protocol for duplicate measurements. If the test kit you are placing is duplicate measurement also be sure to:

- ☐ Placed duplicate (side-by-side) test kit 4-5 inches away from test kit for that room.

d. Specific protocol for blank measurements. If the test kit you are placing is a blank measurement, also be sure to:

- ☐ Unwrap blanks, open, but then immediately close and reseal them.

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☐ Place the test kit next to the detector kit(s) for the room 4-5 inches away.

e. Specific protocol for spiked test kits.

☐ Arrange for the spiked test kits to arrive back from the Certified Performance Test Chamber to the School Measurement Team as close to the day that kits are retrieved from the school as possible. [See *Quality Assurance Procedures for a School Radon Measurement Progra*m in OHA's Testing for Elevated Radon in Oregon Schools.]

f. Testing Period.

The minimum length of time test kits should be left out is 48 hours, but not exceed seven days. [It's best to follow test kit manufacturer's instructions for more specific recommendations.] It's best if devices should be left in place for four days to ensure optimum results.

Many schools place short-term kits on Monday morning and pick them up on Thursday morning. Retrieving Kits: Once the testing period has ended, all test kits placed at a school site (detectors, duplicates, and blanks) need to be retrieved. This should be done on the same date. Complete the data sheet when retrieving detectors.

☐ Record ending date and time (kits were pick up) information, per the "Test Kit Placement Log" [Appendix D of OHA's Testing for Elevated Radon in Oregon Schools.]

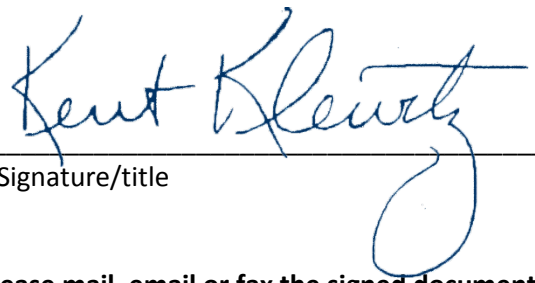
☐ Record ending information on the test kit package (if required).

g. Prepare and mail all kits.

☐ Seal and prepare test kits to be mailed to the lab by the manufacturer's instructions.

☐ Include those spiked kits (not identified as such) in the same box(es) as other kit types.

☐ Mail all test kits (detectors, duplicates, blanks, spikes) to the Radon Measurement Laboratory using a mail service that guarantees delivery to the laboratory within two days at maximum, but **preferably overnight** shipping.



9/1/2016

Signature/title Date

Please mail, email or fax the signed document:

MAIL TO: Oregon Radon Awareness Program
800 NE Oregon St, Suite 640
Portland, OR 97232-2162

FAX TO: 971-673-0979
EMAIL TO: radon.program@state.or.us

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Appendix B: Mitigation Guide

Like most other indoor air contaminants, radon can best be controlled by keeping it out of the building in the first place rather than removing it once it has entered.

It is likely impossible to reduce a school's radon to zero. Again, the goal of radon reduction is harm reduction.

Radon can be controlled through:

- HVAC systems. Adjustment to the heating, ventilation and air conditioning systems serving a room may reduce radon levels to below EPA's action level guideline of 4 pCi/L.
- Soil depressurization. A suction fan is used to produce a low-pressure field in soil under the building slab. This low-pressure field prevents radon entry by ventilating the gas outside before it has a chance to get drawn into the building.
- Building pressurization. Indoor/soil pressure relationships are controlled to prevent radon entry. More outdoor air is supplied than exhausted so the building is slightly pressurized compared to both the exterior of the building and the sub-soil area.
- Sealing entry routes. Seals are installed at major entry routes to minimize radon entry.
- Zone-specific ventilation. A building's crawlspaces, tunnels, conduits, vaults, etc. may be used to design a system that reduces its elevated radon.

For new school buildings, a cost-effective method to control radon is radon resistant new construction (RRNC). Because a building's potential for elevated radon cannot be measured before it is constructed, specific components of a radon mitigation system (e.g., gravel layers, ventilation pipes) are installed while the building is under construction.

If, after testing, elevated radon is found in the finished building, a radon fan can easily be added and the system activated. Under current statute, RRNC is required in all public buildings (including schools) and residences built after April 1, 2013, in seven Oregon counties (Baker, Clackamas, Hood River, Multnomah, Polk, Washington and Yamhill).

For existing buildings, the most effective and frequently used radon reduction technique is adjustment of a building's HVAC system. This method directly influences radon entry by altering air pressure and dilution differences between the radon in the soil and building interior. Depending on the type and operation, an HVAC system can create positive or negative air pressure. Positive pressure can prevent radon entry, while negative pressure enhances radon entry. The positive pressure can be achieved through additional heating, cooling and/or dehumidification, along with enhanced routine operation and maintenance. A number of school districts across the country, upon finding elevated radon in just a few rooms in a school building, have lowered the radon levels in those rooms by altering the building's HVAC system.

At a certain point, however, such adjustments can reduce the effectiveness (and increase operational costs) of components in this system. Such ongoing operational costs may be greater than the upfront costs of active soil depressurization (ASD).

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If adjustment of a building's HVAC system does not lower a room(s) elevated radon, a common radon reduction method is ASD. ASD is especially effective with higher levels of radon. ASD creates a lower pressure in the underlying soil to reverse the flow of air through a building foundation, thereby reducing radon entry. A series of pipes draw radon gas from underlying soil while an inline high suction fan is attached to these pipes to vent the soil gas from beneath the building foundation. ASD is accompanied by sealing radon entry routes, which improves radon removal efficiency and reduces energy costs. ASD, however, has no effect on general air quality within the building.

Radon typically enters the building from the soil through cracks and openings in the slabs and sub-structure. However, it is difficult, if not impossible, to seal every crack and penetration. Therefore, sealing radon entry routes is often used in conjunction with other mitigation techniques, and not considered a long-term solution by itself.