6 George Whittell High School

6.1 Description

Short-term radon measurements were conducted in this school from March 17-19, 2009. The results obtained from these tests reflect the conditions that existed within this school and within these dates.

Tests were conducted in accordance with the US EPA's Guidance Document Radon Measurements in Schools, Revised Edition, EPA 402-R-92-014, July 1993.

These tests included all frequently occupied ground floor rooms within all structures on the campus, including the drama room in the old transportation building as well as offices within the newer transportation building. Additional details on the methodology of these tests as well as room selection can be found in Section 1.2 of this report.

Locations tested:	56
Locations where devices retrieved:	56
Locations with short-term results at or above 4.0 pCi/L:	7
Rooms at or above 4.0 pCi/L:	Rooms 11-Kiln, 12A, 12B, 18, 18-Office, Library, Conference Rm.
Survey anomalies:	Due to lack of keys during retrieval phase for the new transportation area, these two devices were retrieved one day later than other devices at this campus, but the extended deployment time was well within parameters.

Quality control and quality assurance measures that were taken for this school, which are detailed in Section 13, indicate that confidence can be placed in the survey results for this facility.

6.2 Results

The results provided below in both tabular and pictorial form represent the radon levels within these locations that were present at the time of the survey and under the condition in which the building was being operated, including its HVAC system. Locations determined to have short-term radon levels at or above 4.0 pCi/L are shown in "bold" within the table and in red on the diagram.

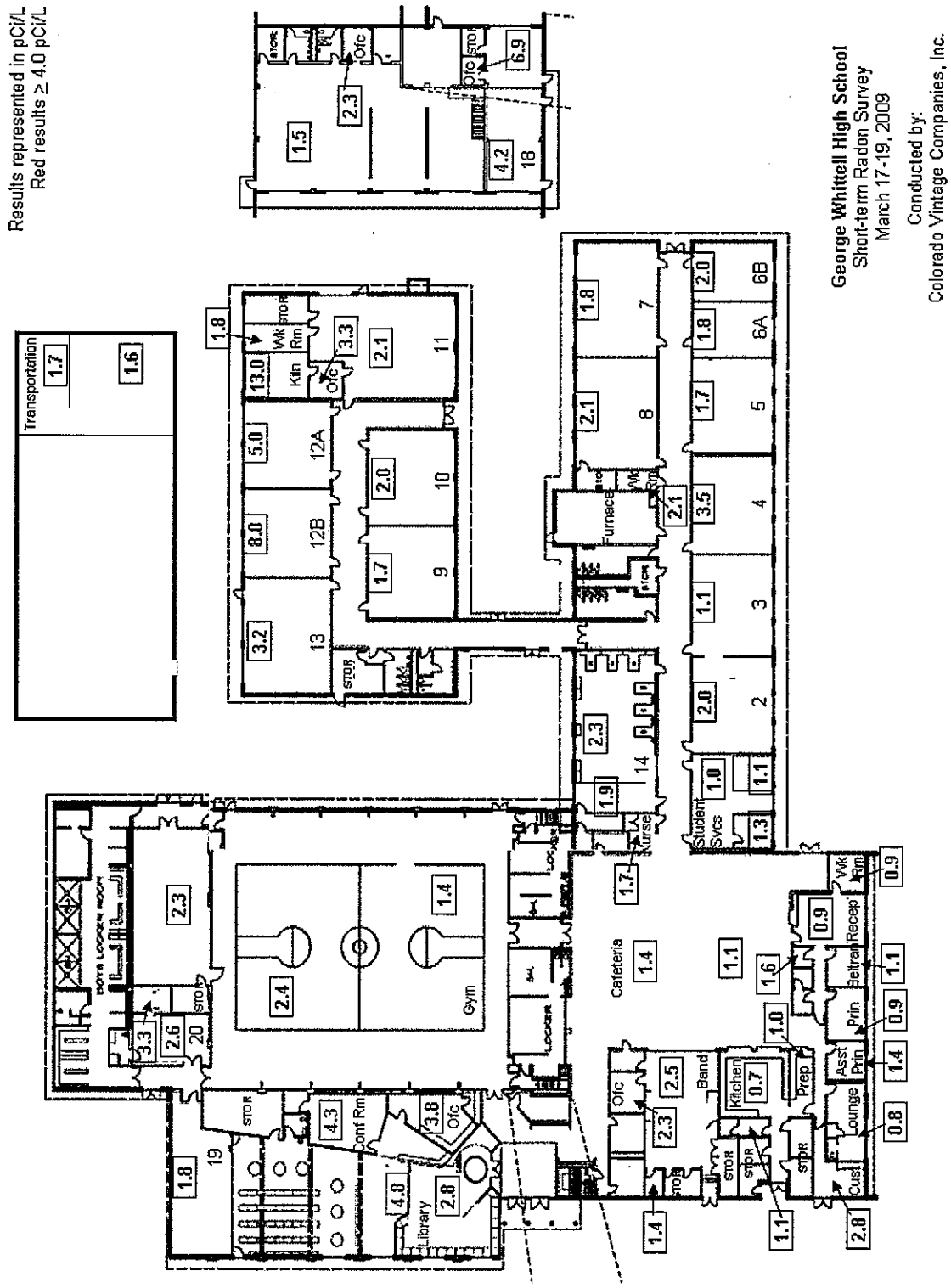
All times indicated are Eastern Daylight Savings Time. Results indicated as <0.3 pCi/L are at the lower level of detection for the devices.

Table 7: George Whittell High School Radon Survey Results

Room	Device	Start Date	Start Time	End Date	End Time	Result (pCi/L)
2	4328979	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.0
3	4328978	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.1
4	4328985	2009-03-17	6:00 pm	2009-03-19	10:00 pm	3.5
5	4328973	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.7
6A	4328406	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.8
6B	4328412	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.0
7	4328410	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.8
8	4328972	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.1
9	4328988	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.7
10	4328970	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.0
11	4328411	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.1
11 Kiln	**4328989**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**13.0**
11 Office	4328404	2009-03-17	6:00 pm	2009-03-19	10:00 pm	3.3
11 Wkroom	4328419	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.8
12A	**4328997**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**5.0**
12B	**4328980**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**8.0**
13	4328415	2009-03-17	6:00 pm	2009-03-19	10:00 pm	3.2
14	4328407	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.3
14 Aux	4328981	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.9
18	**4328992**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**4.2**
18 Office	**4328961**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**6.9**
19	4328954	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.8
20	4328937	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.6
20 Office	4328932	2009-03-17	6:00 pm	2009-03-19	10:00 pm	3.3
Asst Prin	4328960	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.4
Band	4328944	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.5
Band Ofc	4328941	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.3
Band Prac	4328943	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.4
Beltran	4328950	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.1
Cafeteria 1	4328925	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.1
Cafeteria 2	4328930	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.4
Conference	**4328946**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**4.3**
Counselor	4328974	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.1
Cust Ofc	4328963	2009-03-17	5:00 pm	2009-03-19	10:00 pm	2.8
Esquivel	4328939	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.3
Gym 1	4328414	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.4
Gym 2	4328965	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.4
Kitchen	4328959	2009-03-17	5:00 pm	2009-03-19	10:00 pm	0.7
Kitchen Ofc	4328953	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.1
Kitchen Prep	4328945	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.0
Library 1	4328401	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.8
Library 2	**4328949**	**2009-03-17**	**6:00 pm**	**2009-03-19**	**10:00 pm**	**4.8**
Lounge	4328958	2009-03-17	5:00 pm	2009-03-19	10:00 pm	0.8
Maint Ofc	4328955	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.3
Nurse	4328933	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.7
Ofc Wkroom	4328931	2009-03-17	5:00 pm	2009-03-19	10:00 pm	0.9

Room	Device	Start Date	Start Time	End Date	End Time	Result (pCi/L)
Office	4328971	2009-03-17	6:00 pm	2009-03-19	10:00 pm	3.8
Principal	4328967	2009-03-17	5:00 pm	2009-03-19	10:00 pm	0.9
Reception	4328942	2009-03-17	5:00 pm	2009-03-19	10:00 pm	0.9
Security	4328957	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.6
Shop	4328952	2009-03-17	6:00 pm	2009-03-19	10:00 pm	1.5
Student Svcs	4328938	2009-03-17	5:00 pm	2009-03-19	10:00 pm	1.0
Transp Ofc	4328947	2009-03-17	7:00 pm	2009-03-20	5:00 pm	1.7
Transportation	4328966	2009-03-17	6:00 pm	2009-03-20	5:00 pm	1.6
Weight	4328948	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.3
Workroom	4328408	2009-03-17	6:00 pm	2009-03-19	10:00 pm	2.1

Figure 6: George Whittell High School Radon Survey Results



6.3 Discussion

It is apparent that the potential exists at this school for elevated radon. This is not totally surprising due to the granite geology at this school and its proximity to Zephyr Cove Elementary where previous testing had led to the installation of active soil depressurization systems.

In particular, the Kiln Room had a short-term reading of 13.0 pCi/L. It is highly likely that, assuming the Kiln was in use during the test period, that either the natural venting of the Kiln or the presence of mechanical exhaust systems to withdraw exhaust gases from the Kiln are causing significant negative pressures in this room that would cause radon to enter through the foundation. This effect is also likely the cause for elevated measurements in the adjacent Rooms 12A and 12B.

The measurements for Rooms 12A, 12B and the Kiln Room can also be compared to much lower measurements on the opposite side of the hallway. This dichotomy of results is likely due to separate air handlers serving opposite sides of the hallway, or an imbalance in the supply ductwork, if there is a common FAU for this portion of the building.

The same imbalancing of air supply is also the likely cause for elevated measurements in the Library and its nearby Conference Room as well the Drama area in the old transportation building.

With respect to the delayed pick up of the two devices in the new transportation office, the deployment period was three days rather than two days for the balance of the devices within this campus, but well within laboratory specifications for maximum test deployment. This occurrence does not warrant the retesting of these two locations.

6.4 Recommendations

- Confirm elevated radon levels within elevated rooms with the use of a continuous radon monitor that, in addition to providing a confirmatory integrated measurement, it would also provide a more informative indication of the daytime to nighttime averages of radon exposure.
- Review HVAC system for elevated locations with a special attention given to the operation of exhaust systems that may be present in the Kiln area.
    - Insure both the presence and capacity of air supply to these rooms
    - Adjust supply to maintain a 0.010 inch of water column positive pressurization within these rooms relative to the sub-grade.
        - Verify that positive pressure is maintained in all other rooms that are served by the air handler that serves the rooms that are elevated. If not, increase capacity of the air handler to insure positive pressure through adjustments to fresh air make-up and/or fan speed.
- After adequate HVAC adjustments have been accomplished, conduct short-term confirmatory measurements in all rooms served by the HVAC system that serves the rooms that are elevated.

Maintenance

Given the potential for this school to have elevated radon levels, a program should be instituted that:

1. Retest all rooms that are mitigated, once every year as recommended by US EPA protocols
2. Retest rooms after renovations, which would affect air flow and air supply, occur. This would include but not be limited to situations when:
    - HVAC system is modified, (Retest rooms affected by HVAC that is modified)
    - Partition walls are added within a room,
        - Insure that renovations include provisions for balanced air supply and return from newly created room.
    - Additions occur at this campus, whether they are new buildings or portable classrooms.
3. Maintain fresh air make-up in conformance with ASHRAE standards and state codes for schools and to insure an interior positive building pressure during occupied hours.
4. Develop a database either specifically for this school or district wide for all schools that allows for the retention of future test results that clearly delineate:
    1. Location
    2. Date of test
    3. Purpose of test (routine, post-mitigation or post renovation, etc.)
    4. Method by which room nomenclature is maintained or a clear means of determining when names are changed or rooms added.