



SD45 RADON MITIGATION GUIDANCE

April 5, 2019

Attn: Jamie Ross, Julia Leiterman, Dmitri Eliasov
School District 45, West Vancouver Schools
École Cedardale Elementary
Cypress Park Primary School

RADON MITIGATION GUIDANCE CEDARDALE + CYPRESS PARK

PROJECT OVERVIEW

Three phases of radon testing were conducted at School District 45, West Vancouver Schools properties, École Cedardale Elementary and Cypress Park Primary School. This testing was to determine whether elevated levels were present at the schools and the mitigation action necessary to correct them.

Exposure to elevated radon in all indoor environments, specifically schools and workplaces as relevant to this project, presents a known human health hazard, including an increased risk of developing lung cancer (see references at the end of this report for further information).

MEASUREMENT BACKGROUND

Vancouver Coastal Health results from Phase One testing in early 2018 showed elevated levels at both properties.

Radon Environmental's Canadian National Radon Proficiency Program (C-NRPP) certified professionals carried out Phase Two measurements with alpha track detectors in fall 2018 to determine daytime and nighttime classroom levels and options for mitigative action.



PHASE THREE MEASUREMENT

Phase Three testing was conducted by Radon Environmental's C-NRPP professionals in March 2019 to collect hourly data required for an assessment of occupied building hour exposure and potential mitigative action. Professional continuous radon monitors (CRMs) were deployed over a ten-day measurement period in two classrooms at each property. See *Detailed Hourly Measurements of Radon Concentration* reports and *Plot of Radon Levels* (note: the first 72 hours of measurements are not included in calculations as the CRMs calibrate to specific building conditions during this time).

The CRMs collected hourly readings to provide data necessary to guide actions, if necessary, by the West Vancouver Schools Facilities Department. Facilities may correct the indoor radon levels during occupied building hours (Monday through Friday, 7am to 7pm) using the building's existing ventilation systems as needed.

A certified C-NRPP measurement report is included summarizing the average radon levels for the two measured rooms in each school during the entire testing period, the maximum radon value (peak result) found in each room at a single hour, and the average radon level during occupied building hours. It is this last calculation that will be used in guiding mitigative action.

MITIGATION RECOMMENDATION

Various thresholds for public radon exposure, beyond which corrective measures to reduce exposure are recommended, are followed by institutions within the Province of British Columbia. The current Health Canada guideline for radon in indoor air is 200 Bq/m³ (by comparison the World Health Organization recommended action level is 100 Bq/m³ and the US EPA action level is 148 Bq/m³).

Based on Phase Three measurement results for each school building, no mitigation action is necessary should West Vancouver Schools operate to the Health Canada standard. The average radon level for the measured rooms during occupied building hours for Cedardale and Cypress Park, as outlined in the measurement report, are below the Canadian guideline.

As hourly radon levels often reach a peak beyond the Canadian guideline, it is strongly recommended the school district facilities management further investigate how greater volumes of air can be moved in the gyms of each school. The hourly radon levels during occupied building hours in the gyms are sufficiently high throughout the day that the air handling systems should be adjusted to increase the air intake and exhaust.



RADON SYSTEM IDENTIFICATION

In order to alleviate the possibility of someone compromising the radon mitigation plan, labelling is necessary wherever manual adjustments may be made. Once the district facilities management has optimized the operation of the air handling systems in Cedardale and Cypress Park gyms, labels to be provided by Radon Environmental will caution that the system is being utilized in radon mitigation: *any adjustment may introduce a risk to building occupant life safety.*

CLOSURE

The information and conclusions contained in this report are based upon work undertaken by trained professionals and technical staff in accordance with generally accepted scientific and occupation health and safety practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice.

The conclusions presented in this report represent the best technical judgement of Radon Environmental Management Corp. based on the data obtained from the site conditions encountered at the time the work was performed at the specific assessment and/or sampling locations. Due to the nature of the investigation and the limited data available, Radon Environmental cannot warrant against undiscovered environmental or health and safety liabilities. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

We trust that the above is satisfactory for your purposes at this time. Should you have any questions or concerns, or require additional information, please do not hesitate to contact the report authors at your convenience.

Sincerely,

Radon Environmental Management Corp.

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REFERENCES

Canadian Guideline for Radon

<https://www.canada.ca/en/health-canada/services/radon/take-action-on-radon.html>

Canadian National Radon Proficiency Program


<https://c-nrpp.ca>



CERTIFIED RADON MEASUREMENT REPORT

April 3, 2019

Attn: Jamie Ross, Julia Leiterman, Dmitri Eliasov
School District 45, West Vancouver Schools
 École Cedardale Elementary
 Cypress Park Primary School

Measurement Technician	Testing Location	Deployment Date	Retrieval Date
School District 45			
 Alana McFarlane CRT#201108	Cedardale Gym + Unit 101	Cedardale March 15, 2019	Cedardale March 25, 2019
	Cypress Park Gym + Unit 5 (Daycare)	Cypress Park March 5, 2019	Cypress Park March 15, 2019

Measurement Method	Testing Period	Levels Tested
Corentium Pro C-NRPP listed continuous radon monitor	Hourly readings over a period of ten (10) days.	Ground floor

See attached *Detailed Hourly Measurement of Radon Concentration* data by 24-hour periods and *Plot of Radon Levels*. Note: device calibrates first 72 hours of readings – these readings not included in calculations.

Pre mitigation measurements to determine the direction of mitigative action. Further adjustments may be considered as per changes to building occupant use.

Measurement within the gyms at both École Cedardale Elementary and Cypress Park Primary School resulted in average radon levels during occupied building hours above the World Health Organization recommended action level of 100 Bq/m³. For both gyms and each of the additional tested rooms at each property, the radon levels are below the Canadian guideline for radon in indoor air of 200 Bq/m³. Notable values are as follows.

Average radon level (not including 72-hour calibration period) during the **occupied building hours** of 7am to 7pm, Monday to Friday:

- Cedardale – 174 Bq/m³ in gym and 13 Bq/m³ in Unit 101; and
- Cypress Park – 114 Bq/m³ in gym and 52 Bq/m³ in Unit 5 (Daycare).



CERTIFIED RADON MEASUREMENT REPORT

Average radon level (not including 72-hour calibration period) during the **entire testing period:**

- Cedardale – 112 Bq/m³ in gym and 33 Bq/m³ in Unit 101; and
- Cypress Park – 146 Bq/m³ in gym and 75 Bq/m³ in Unit 5 (Daycare).

The following maximum levels were reported during a one-hour period in each room during the occupied building hours of 7am to 7pm, Monday to Friday:

- Cedardale – 284 Bq/m³ in gym and 57 Bq/m³ in Unit 101; and
- Cypress Park – 273 Bq/m³ in gym and 129 Bq/m³ in Unit 5 (Daycare).

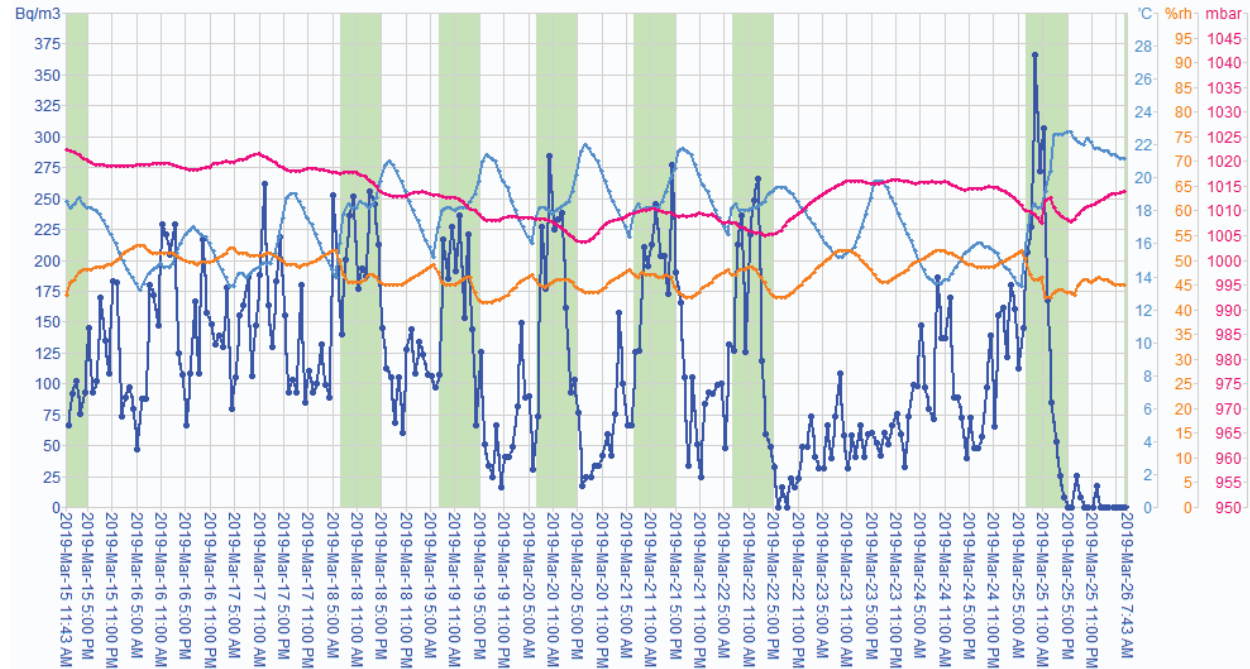
Radon mitigation action is recommended at this time for the gyms at both SD45 school properties, Cedardale and Cypress Park. See details within the *SD45 Radon Mitigation Guidance* report.

Radon testing should be performed by a C-NRPP certified measurement professional at least every two years as building conditions and use change affecting radon in indoor air.

All measurement and mitigation professionals with Radon Environmental are certified by the Canadian National Radon Proficiency Program (C-NRPP). Further information is available at <https://c-nrpp.ca>.

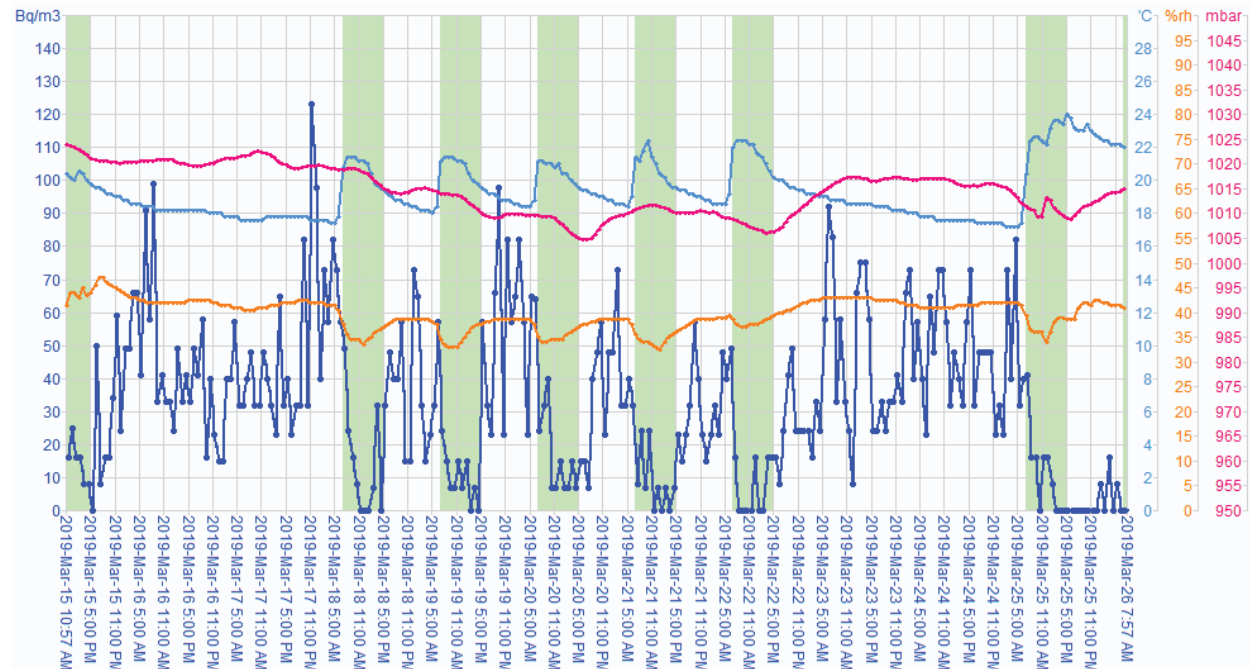
**SD45 Cedardale 3rd Phase
Measurement for Mitigation Action.
Plot of Radon Levels (Bq/m³)
with Temperature, Relative Humidity,
and Pressure.**

**15-March-2019 to 25-March-2019
Gym**



**SD45 Cedardale 3rd Phase
Measurement for Mitigation Action.
Plot of Radon Levels (Bq/m³)
with Temperature, Relative Humidity,
and Pressure.**

**15-March-2019 to 25-March-2019
Unit 101**



SD45 Cedardale, Detailed Hourly Measurement of Radon Concentration 15-March-2019 to 25-March-2019

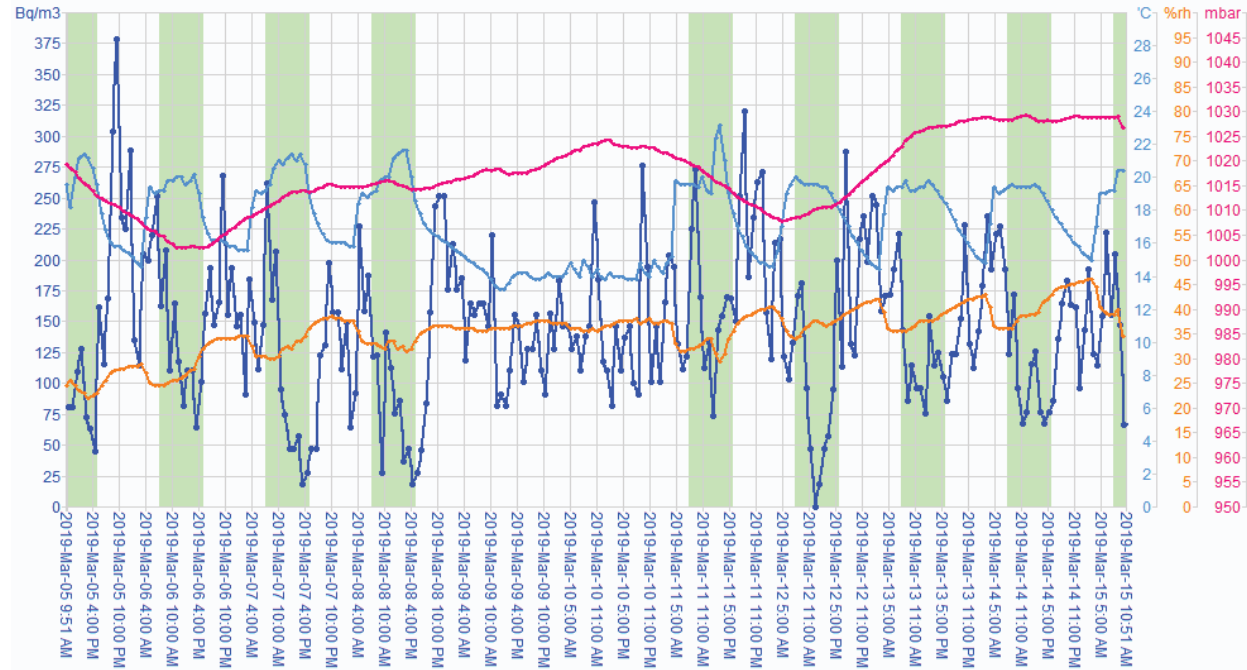
note: device calibrates first 72 hours of readings

Gym radon values in Bq/m3																								
	12:13 AM	1:13 AM	2:13 AM	3:13 AM	4:13 AM	5:13 AM	6:13 AM	7:13 AM	8:13 AM	9:13 AM	10:13 AM	11:13 AM	12:13 PM	1:13 PM	2:13 PM	3:13 PM	4:13 PM	5:13 PM	6:13 PM	7:13 PM	8:13 PM	9:13 PM	10:13 PM	11:13 PM
March 18, 2019													193	187	256	246	213	145	113	105	69	105	60	128
March 19, 2019	144	108	134	124	107	106	97	107	217	185	227	191	236	153	221	144	66	126	51	34	25	67	16	41
March 20, 2019	41	49	82	149	89	90	31	74	227	177	284	225	233	238	162	93	103	77	17	25	25	34	34	42
March 21, 2019	59	42	76	158	100	66	66	126	127	211	195	213	246	204	204	173	277	190	166	105	34	105	51	25
March 22, 2019	84	93	92	99	100	48	132	127	213	236	126	221	249	266	119	59	49	33	0	16	0	24	16	24
March 23, 2019	49	49	74	41	32	32	66	40	74	108	58	32	58	41	67	41	59	60	52	42	60	51	67	76
March 24, 2019	59	33	74	99	98	147	97	80	72	186	137	137	170	89	89	73	40	73	48	48	57	97	139	65
March 25, 2019	156	162	122	180	161	113	145	207	227	366	272													

Unit 101 radon values in Bq/m3																								
	12:27 AM	1:27 AM	2:27 AM	3:27 AM	4:27 AM	5:27 AM	6:27 AM	7:27 AM	8:27 AM	9:27 AM	10:27 AM	11:27 AM	12:27 PM	1:27 PM	2:27 PM	3:27 PM	4:27 PM	5:27 PM	6:27 PM	7:27 PM	8:27 PM	9:27 PM	10:27 PM	11:27 PM
March 18, 2019												0	0	0	7	32	0	32	48	40	40	57	15	15
March 19, 2019	73	65	32	15	23	32	57	24	15	7	7	15	7	15	0	7	0	57	32	23	66	98	23	82
March 20, 2019	57	65	82	57	23	65	64	24	32	40	7	7	15	7	7	15	7	15	15	7	40	48	57	23
March 21, 2019	48	48	73	32	32	40	32	8	24	7	24	0	7	0	7	0	7	23	15	23	32	57	40	23
March 22, 2019	15	23	32	23	48	40	49	16	0	0	0	0	16	0	0	16	16	16	8	24	41	49	24	24
March 23, 2019	24	24	16	33	24	58	92	83	33	58	33	24	8	66	75	75	58	24	24	33	24	33	33	41
March 24, 2019	33	66	73	40	57	40	23	65	48	73	73	57	32	48	40	32	57	73	32	48	48	48	48	23
March 25, 2019	32	23	73	40	82	32	40	41	16	16	0													

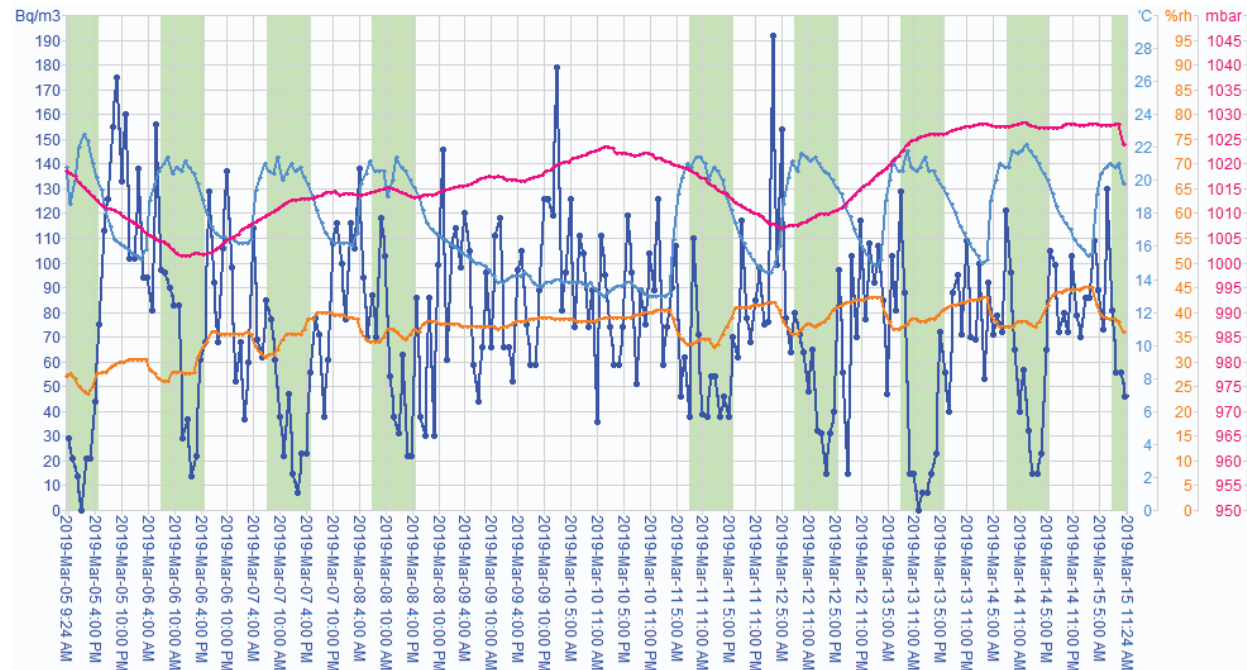
**SD45 Cypress Park 3rd Phase
Measurement for Mitigation Action.
Plot of Radon Levels (Bq/m³)
with Temperature, Relative Humidity,
and Pressure.**

5-March-2019 to 15-March-2019
Gym



**SD45 Cypress Park 3rd Phase
Measurement for Mitigation Action.
Plot of Radon Levels (Bq/m³)
with Temperature, Relative Humidity,
and Pressure.**

5-March-2019 to 15-March-2019
Unit 5, Daycare



SD45 Cypress Park, Detailed Hourly Measurement of Radon Concentration 5-March-2019 to 15-March-2019

note: device calibrates first 72 hours of readings

Gym radon values in Bq/m3

	12:21 AM	1:21 AM	2:21 AM	3:21 AM	4:21 AM	5:21 AM	6:21 AM	7:21 AM	8:21 AM	9:21 AM	10:21 AM	11:21 AM	12:21 PM	1:21 PM	2:21 PM	3:21 PM	4:21 PM	5:21 PM	6:21 PM	7:21 PM	8:21 PM	9:21 PM	10:21 PM	11:21 PM
March 8, 2019											141	113	76	86	37	47	18	28	46	84	158	243	252	252
March 9, 2019	176	213	176	185	119	165	156	165	165	146	220	82	91	82	110	155	146	101	128	128	155	110	91	157
March 10, 2019	128	183		146	146	128	138	110	138	146	247	184	118	110	82	146	110	137	146	100	91	276	194	101
March 11, 2019	146	101	166	204	194	132	112	122	225	273	170	113	133	74	143	154	170	169	150	252	320	186	234	263
March 12, 2019	271	158	120	214	217	122	103	133	171	181	96	47	0	18	47	57	95	200	114	287	132	123	217	235
March 13, 2019	198	252	245	159	171	172	192	221	143	86	115	96	96	76	154	115	125	105	86	124	124	152	228	132
March 14, 2019	113	142	179	235	192	221	227	192	124	172	96	68	77	116	126	77	68	77	86	136	165	183	164	162
March 15, 2019	96	143	192	124	115	154	222	155	205	147														

Unit 5, Daycare radon values in Bq/m3

	12:54 AM	1:54 AM	2:54 AM	3:54 AM	4:54 AM	5:54 AM	6:54 AM	7:54 AM	8:54 AM	9:54 AM	10:54 AM	11:54 AM	12:54 PM	1:54 PM	2:54 PM	3:54 PM	4:54 PM	5:54 PM	6:54 PM	7:54 PM	8:54 PM	9:54 PM	10:54 PM	11:54 PM
March 8, 2019										103	54	38	31	63	22	22	86	38	30	86	30	99	146	61
March 9, 2019	107	114	98	120	105	59	44	66	96	66	111	118	66	66	52	97	105	75	59	59	89	126	126	119
March 10, 2019	179	81		96	126	74	111	104	74	89	36	111	95	74	59	59	74	119	96	51	89	75	104	89
March 11, 2019	126	59	74	90	107	46	62	38	110	71	39	38	54	54	38	46	38	70	62	117	78	68	85	98
March 12, 2019	75	76	192	99	154	78	64	80	71	64	48	65	32	31	15	31	40	97	56	15	103	70	117	77
March 13, 2019	108	92	107	85	47	103	81	129	88	15	15	0	7	7	15	23	72	56	40	88	95	71	109	70
March 14, 2019	69	100	53	92	71	79	72	121	96	65	40	57	32	15	15	23	65	105	99	72	80	72	103	79
March 15, 2019	70	86	86	109	89	73	130	81	56															