



SMALL-SCALE SITES
RESURVEY - PROPERTY
SURVEY REPORT FOR SITE
[REDACTED]
STREET PORT HOPE

Port Hope Area Initiative Port
Hope Project

4501-121250-REPT-021

Revision 0

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**ATOMIC ENERGY OF CANADA LIMITED
PORT HOPE, ONTARIO, CANADA**

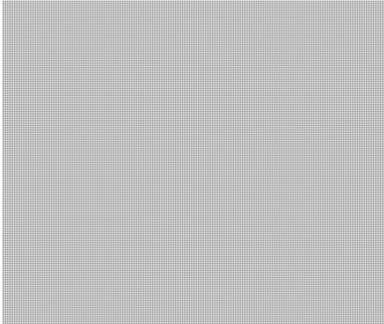
**SMALL-SCALE SITES RESURVEY
AND REMEDIATION TRIALS COST ASSESSMENT**

PROPERTY SURVEY REPORT FOR
[REDACTED]
PORT HOPE

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CLIENT: ATOMIC ENERGY OF CANADA LIMITED (AECL)

PROJECT: SMALL-SCALE SITES RESURVEY AND REMEDIATION TRIALS COST ASSESSMENT (SRCA)

	SIGNATURE	DATE
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ISSUE/REVISION INDEX

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1.0 INTRODUCTION

Under the Port Hope Area Initiative (PHAI), properties within Ward 1 of the Municipality of Port Hope will be resurveyed for the presence of historic low-level radioactive waste (LLRW). Properties found to have LLRW above the established PHAI Clean-up Criteria (PHAI CC) will be remediated. These properties are described as small-scale remediation sites and include residential, industrial / commercial, institutional, woodlot and park properties.

Atomic Energy of Canada Limited (AECL), on behalf of the Port Hope Area Initiative Management Office (PHAI MO), retained SNC-Lavalin Inc. (SLI) to provide the field resurvey and remediation / restoration trials for the Small-Scale Sites Resurvey and Remediation Trials Cost Assessment (SRCA) project. SLI subcontracted Kinectrics Inc. to provide services and equipment for the radiological component of the resurvey and remediation work and laboratory analysis of soil and other materials. The Low-Level Radioactive Waste Management Office (LLRWMO) provided project management on behalf of AECL and also provided technical support and radiological laboratory analysis of soils for Ra-226.

The SRCA project included the resurvey of 35 selected sites, and the planned remediation of selected sites. The information gathered during the trials resurvey and remediation program was used to develop resurvey and remediation procedures and to provide an updated estimate of the cost for the larger re-survey and remediation project to follow.

An initial survey and site investigation was undertaken on each of the 35 sites to determine the potential presence of historic LLRW. The resurvey of the site consisted of the following components:

- indoor radon survey;
- interior and exterior gamma radiation dose rate surveys;
- interior and exterior surface contamination surveys;
- exterior intrusive investigation (drilling and soil sampling);
- gamma radiation survey of the soil core and borehole; and
- analytical testing of the soil.

The clean-up criteria adopted for the SRCA project (Ref. 1) are defined in terms of primary and secondary Contaminants of Potential Concern (COPCs). The clean-up criteria and their application are described in more detail in Section 5.3.3.

Under the SRCA project, small-scale sites are separated into five generic types:

1. Type A: Property with survey results less than PHAI CC;
2. Type B: Property with survey results above the PHAI CC, but not from historic LLRW;
3. Type C: Property with LLRW contaminated soils not exceeding 25% of the area of the property;

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4. Type D: Property with LLRW contaminated soils exceeding 25% of the area of the property; and
5. Type E: Property with LLRW contaminated materials in unique conditions requiring site-specific (i.e. one-of-a-kind) remediation plans and cost estimates.

This report details the results of the resurvey activities undertaken at [REDACTED] in July and August of 2010, and in March of 2011. This site was classified under the SRCA project as a Type A site, and is identified as [REDACTED] within the SRCA project. Property type classifications were based on a high-level review of the historic property file. Detailed file and subsequent field data reviews conducted following the start of work confirmed the initial classification.

Property owner consent was required prior to inclusion of this property in the SRCA project. PHAI MO Communications staff were responsible for arranging a meeting with the property owner to describe the program and to obtain consent for the resurvey at the site. The resurvey work was scheduled with the owner by SLI staff, and a letter confirming the time of the initial work (Initial Site Screening) was hand delivered to the owner in advance of the work. Notices were also delivered by PHAI MO Communications Staff to neighbours to advise them of the program. The subsequent Site Investigation work (drilling), was also scheduled with the property owner by SLI staff.

The signed consent form, the notice of work, and the notice provided to the neighbours are attached in Appendix A.

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2.0 SITE LOCATION

[REDACTED] is located in Ward 1 of the Municipality of Port Hope. It occupies [REDACTED] of the Township of Hope, now the Municipality of Port Hope. The property is rectangular-shaped covering an area of approximately 0.282 acres.

A copy of the legal survey obtained for this site is attached in Appendix B. The historic property file review indicates a development date prior to 1976.

The property is fully developed with a two storey semi-detached house, a small shed and a detached garage. The house is located in the western portion of the property. The garage and the shed are located east of the house.

Access to the front of the property is by the driveway off [REDACTED] There is no rear access to the property.

2.1 Site Mapping

A base map of this site was prepared based upon existing ortho-rectified air photo mapping available through the LLRWMO, and the legal survey. The base map was used for the geo-referencing of data collected for each site in subsequent investigations.

Figure 1 shows the base map prepared for this site.

Historical data as well as data from the resurvey were compiled in a GIS database. Each property in the database is assigned a unique identifier number which is linked to the roll number obtained from the LLRWMO's Port Hope property fabric. The unique database identifier for [REDACTED]

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3.0 HISTORIC FILE INFORMATION

The LLRWMO maintains files containing radiological information for properties located within the Municipality of Port Hope. These files are comprehensive and include all correspondence with the owner of the property, and the findings of any radiological investigations that may have occurred. Often the correspondence is initiated for a purchase or sale of a property, or for investigations undertaken for the Construction Monitoring Program (CMP) for the field testing and management of contaminated soil in the town. However, there are properties where significant investigations and remediation were undertaken in the late 1970's and early 1980's by the Atomic Energy Control Board (AECB), now the CNSC.

Prior to conducting any site activities for this SRCA project, a review of the property file was undertaken. No concerns were identified during the file review for this property with the exception of elevated gamma readings exhibited by the old bricks of a small brick wall located on the eastern portion of the property in 1976.

Notes from the file review are provided in Appendix C.

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4.0 FIELD ACTIVITIES

The following outlines the field activities that were undertaken at [REDACTED]

4.1 Stage 1A – Site Screening

This stage comprised the deployment of the indoor radon monitors, interior and exterior gamma radiation dose rate surveys and surface and objects assessments. This portion of work was undertaken by Kinectrics staff.

Prior to conducting the initial site screening, photographs of relevant interior and exterior property features were taken to record initial site conditions or actual / potential issues. These photos were kept by Kinectrics for later retrieval, if necessary.

4.1.1 Indoor Radon Surveys

Indoor radon measurements were performed using Electret Passive Environmental Radon Monitors (EPEMNs). The EPEMNs were placed in the basement and in the dining room on the main level. Gamma radiation exposure rate readings were recorded at the monitor locations in order to correct measured data for effects due to ambient gamma radiation levels. During retrieval, the monitors were inspected for tampering and/or damage which may have potentially invalidated the measurements. The radon monitors were deployed on July 20, 2010, and were retrieved on July 26, 2010. Results of the radon survey are presented in Appendix F.

4.1.2 Interior Gamma Radiation Survey

The interior gamma radiation survey was done using a gamma radiation detector (Thermo FHZ 672 E-10 NBR coupled to a rate meter Thermo FH 40 GL-10). The detector is factory calibrated to read in units of nano Sieverts per hour (nSv/h); the reading is corrected for natural background radiation. For interior surveys, the equipment was strapped to a shoulder harness and readings were collected at hip level on an approximately 1 x 1 m grid. Measurements were taken in individual rooms on all levels of the house. If an elevated gamma radiation reading was found in any room, further assessment was carried out to identify reasons for the elevated gamma radiation reading and to locate potential surface contamination. Results of the interior gamma radiation survey are presented in Appendix D.

4.1.3 Exterior Gamma Radiation Survey

For the exterior gamma radiation survey, a mobile cart equipped with Global Positioning System (GPS) capability and two gamma radiation detector systems (Thermo FHZ 672 E-10 NBR coupled to a rate meter Thermo FH 40 GL-10) was used. The GPS unit is capable, after post-processing, of outputting positional information within 30 cm accuracy. Both detectors provide a reading, in units of nSv/h. The gamma radiation detectors were located on the cart at distances of 15 cm and 1 m above ground level. All accessible areas on the site, including the driveway,

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were surveyed using the cart, based approximately on a 1 x 1 m grid. Data for both detectors as well as the GPS location were automatically logged and finally displayed on a property map for further evaluation. Where site features such as porches, decks, sheds and landscaped areas interfered with the survey grid, readings were taken using one of the detachable cart-mounted gamma radiation measurement devices as close to the grid location as possible. This survey data was recorded manually on a site map and is included as Appendix D.

Data collected by Kinectrics during the site screening was transferred to SLI for overlay onto base maps. This geo-referenced data was returned to Kinectrics for identification of any areas exhibiting elevated gamma radiation readings that were to be considered for further investigation in Stage 1B – Initial Intrusive Investigation.

4.1.4 Surfaces and Objects Assessment

Locations for surface radiation measurements were identified in areas where elevated gamma radiation readings were found during either the interior or exterior survey, and/or where visual inspection of surfaces or objects indicated potential presence of historic LLRW waste or materials. If locations for surface radiation measurements were not identified through gamma readings or visual inspection, locations were selected in typically high traffic areas such as stairs and doorways. Total surface radiation activity was recorded using a hand-held radiation detector with an active face area of 125 cm² (Thermo FHZ 742 coupled to a FH-40 rate meter). If the surface area of the measurement location was smaller than the face of the detector, the measured area of the surface was recorded. Total surface contamination (TSC) readings were taken for alpha, beta and gamma radiation, then with a filter plate in place to measure only gamma radiation. All TSC readings are taken in counts per second (cps). The location of the radiation measurement was recorded on area plans by measuring its distance from reference walls as well as by photographing the area. Total surface contamination readings were then converted to Becquerel per square centimeter (Bq/cm²), and corrected for reduced surface area, if required, to compare to the PHAI CC of 1 Bq/cm² averaged over 100 cm².

Locations for swipe samples to measure for loose alpha radiation were determined based on the surface radiation readings. The PHAI CC for removable (loose) contamination states that, “the removable radioactivity must not exceed 0.4 Bq/cm² for beta and gamma emitters and for “low toxicity” alpha emitters (U isotopes, ²³²Th, ²³⁰Th, ²²⁸Th, and ²²²Rn plus daughters), averaged over 300 cm², and 0.04 Bq/cm² for other alpha emitters.” As ²²⁶Ra, one of the signature parameters of LLRW, is considered a high toxicity alpha emitter, the criterion of 0.04 Bq/cm² averaged over 300 cm² for other alpha emitters is used. In all other cases, swipe samples were obtained over 300 cm² in areas where the measured total surface radiation varied from the gamma radiation, indicating locations of alpha and beta radiation. The location of the swipe sample was recorded on area plans by measuring its distance from reference walls as well as by photographing the area. Swipes were sent to Kinectrics laboratory for analysis. Swipe samples were analyzed using an automated system connected to a proportional counter, with a 30 minute count time per swipe, and results were compared to the PHAI CC of 0.04 Bq/cm² averaged over 300 cm².

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4.1.5 Satisfaction Survey

At the completion of the Site Screening activities, the property owner was asked to complete a Satisfaction Survey to indicate their general level of satisfaction with the activities that were undertaken at the property. The completed Satisfaction Survey presented in Appendix D showed a positive result.

4.2 Stage 1 B – Initial Intrusive Investigation

Prior to undertaking any intrusive investigation, locating of underground and overhead services was undertaken. Locating services were provided by ProMark, and local public providers (Cogeco, Veridian), and overseen by SLI. Utility locations were marked with flags or marking paint and cleared on the ground at each site. The locators provided marked site plans for each site. Marked utility locations on the ground were compared to the Site Plan to ensure that flags or marking paint were not disturbed between the time of locating utilities and drilling.

4.2.1 Drilling Program

The drilling program was dependant on the initial property type classification (i.e. types A to E). [REDACTED] is an A Type site, therefore one (1) confirmatory borehole was advanced at a location that was determined following the Stage 1A – Site Screening, and in a location so as to minimize any adverse affect to the property.

Prior to and following the drilling program, the SLI Site Supervisor photographed and took notes to document site conditions and identify actual / potential issues.

The drilling program was undertaken by Strata Soil Drilling under the supervision of the SLI Site Supervisor. Drilling was conducted using a Geoprobe 420M, a gasoline operated hand-held unit. This drill collects a continuous sample of a diameter of 5.7 cm to 1 m length, encased in a plastic sleeve. Borehole drilling in the SRCA project was done in 1 metre increments to a depth of approximately 3 metres, to refusal, or to native material. At [REDACTED] the borehole extended to 1.80 m, where the drill rig reached native soil. The borehole log is provided in Appendix E.

4.2.2 Down-hole Gamma Radiation Readings

Down-hole gamma radiation readings were taken by Kinectrics at 15 cm increments using a FHZ 512 BGO detector with telescoping adapters. The same detector was also used to take readings from the soil cores which were laid on a plastic table which was covered with a metal sheet to shield the sample from other gamma radiation sources at ground surface. Gamma radiation readings of the soil core were also taken with a Geiger-Mueller detector and portable rate meter. These readings were not used to determine dose, but rather to identify changes in radiological activity at specific depths in the borehole and along the extracted core in order to

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create a profile of radiological activity. The down-hole gamma radiation profile is provided in Appendix E.

4.2.3 Sampling Program

All drilling and soil sampling procedures were conducted in a manner that complies with the project-specific health and safety plan. Sampling personnel were required to wear personal protective equipment including clean, disposable, waterproof gloves, safety boots, side shielded safety glasses and a hard hat.

A tarp was placed beneath the soil sampling area to contain soil that may fall to the ground.

Soil Sampling

Upon retrieval of the soil core, a single composite soil sample was taken from ground surface to the end of the borehole (1.80 m). The sample was collected using a hand trowel at intervals along the core selected to ensure all stratigraphic units were represented in the sample, and placed into a polyethylene sample bag. The sample, identified as [REDACTED]-BH01-001, was double poly-bagged so as to provide maximum containment and to ensure that the resulting data was representative of the site conditions at this location. The soil sample was placed in a cooler containing ice to reduce the sample temperature to approximately 4 degrees Celsius (°C).

Soil samples were delivered directly to the Kinectrics laboratory by the Site Supervisor for laboratory analysis of COPCs. A Chain of Custody (COC) record was completed and accompanied the sample. When the samples were transferred, both the receiving and relinquishing individuals signed the record.

4.2.4 Site Cleanup

After completion of drilling, the borehole was filled with bentonite, covered with topsoil and grass seed placed on top.

The remaining soil associated with the drilling and sampling program that was not a part of the sampling event was bagged for transfer to the Pine Street Extension Temporary Storage Site. This included the remainder of the soil core that was not part of the sample and soil collected on the underlying tarp.

Before leaving the site, all personnel, equipment and material were scanned with a contamination meter. The detector was held at a distance of 1 to 2 cm from the surface to be monitored and moved at a rate of approximately 10 cm/s. All equipment and soil containers were scanned on all sides.

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5.0 FINDINGS

5.1 Radiation Survey

All gamma radiation readings were measured in nSv/h. Measurements were made using devices calibrated using Cs-137, and may vary somewhat from historical information from the LLRWMO property files. All data collected using the automated cart system and from the hand-held measurement device is shown on Figures 3 and 4. All the original forms for the hand-held survey are provided in Appendix D.

Total surface radiation was measured in counts per second (cps), averaged over 125 cm², and was converted to Bq/cm² to compare to the total PHAI CC of 1 Bq/cm² averaged over 100 cm² for total surface contamination. Swipe samples were taken over 300 cm² to measure for loose radiation and compared to the PHAI CC of 0.04 Bq/cm² averaged over 300 cm² for high toxicity alpha emitters. Surface radiation measurement locations and readings are shown in cps on the original field notes included in Appendix D, and in Bq/cm² in Appendix I. Loose radiation measurement results obtained from the assessment of swipe samples are presented in Appendix I.

5.1.1 Interior

The results of the interior gamma radiation survey taken at a height of 1 meter above surface are provided in Figure 2 and ranged from 31 to 71 nSv/h on the three (3) levels of the house. Elevated readings were detected in the northeast corner of the house on the second level (94 nSv/h) and on the interior walls (90 nSv/h) in the same area, and are likely attributed to naturally occurring radionuclide material within the exterior brick cladding.

Total surface radiation readings were taken on the front door threshold, knob, and bench and on the side door threshold, wall and knob. In all locations tested, total surface contamination readings were at or below 0.07 Bq/cm². One swipe sample was taken, from the front door knob. The result was below the PHAI CC with readings of 0.0077 Bq/cm² for loose radiation.

5.1.2 Exterior

The exterior gamma radiation survey was conducted at ground level and at approximately 1 m above the ground. The results of the ground level exterior gamma radiation survey and the gamma radiation survey at 1 m level are provided in Figures 3 and 4, respectively. Some areas could not be surveyed using the cart, therefore these readings were obtained using the hand-held detector. The exterior ground level gamma radiation readings typically ranged from 31 to 70 nSv/h. Slightly elevated readings were detected in association with the brick cladding (100 to 110 nSv/h) and the brick patio (80 to 110 nSv/h). Additionally, large rocks at the northeast corner of the house exhibited a reading of 180 nSv/h. These readings were attributed to the naturally occurring radionuclide material within the brick cladding and rocks.

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Total surface radiation measurements were taken on the front door threshold and the woodshop floor. The total surface contamination readings for both locations was 0.13 Bq/cm². Swipe samples were taken from each of these locations. The results were below the PHAI CC with a reading of 0.0001 Bq/cm² for loose radiation on the woodshop floor and non-detectable on the front door threshold.

5.2 Indoor Radon Measurement

Short-term radon monitoring was performed using four EPERMs installed in pairs at two locations inside the building. The monitors were installed in the basement and in the dining room on the main level. Deployment locations are shown in the field notes in Appendix D and on Figure 2. Details of the radon monitor deployment and the analysis of the results are provided in Appendix F. Test analysis results are summarized in Table 5-1:

Table 5-1: Site [REDACTED] - [REDACTED] Radon Concentration

Average Radon Concentration in the Basement	42.1	Bq/m³
Relative % Difference (RPD)	21%	
Average Radon Concentration in the Dining Room - Main Level	42.4	Bq/m³
Relative % Difference (RPD)	16%	
Average Radon Concentration in the House	42.2	Bq/m³
Relative % Difference (RPD)	1%	

Note: RPD = Relative percentage difference between the monitors at each location

The reported results were below PHAI CC for interior radon of 125 Bq/m³ on both levels of the house.

5.3 Intrusive Investigation

5.3.1 Drilling and Soil Sampling

One (1) borehole was drilled on the property. Visual observation of the core indicated the presence of topsoil underlain by sand and clay with sand and gravel, to the bottom of the borehole at 1.80 m. No visual evidence of LLRW was observed.

5.3.2 Down-hole and Soil Core Gamma Radiation Readings

The down-hole gamma radiation readings showed an elevation in radiological activity at a depth of 0.45 to 0.60 m. This elevation was not noted on the gamma radiation readings taken directly from the soil core.

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5.3.3 Analytical Results

The PHAI CC for Inorganic COPCs are set out in Table 5-2. The criteria are defined in terms of primary and secondary COPCs. A sub-set of four signature parameters are used to identify the presence of LLRW. These are radium, thorium, arsenic, and uranium. For the SRCA project, the COPCs for sites without development constraints were used as these relate to the residential nature of the properties being assessed.

Table 5-2: Recommended Clean-up Criteria^{1,2} for Inorganic COPCs in Soils

	Without Development Constraints ³	LTWMFs and Port Hope Sites with Development Constraints ⁴	Industrial Sites (where no LLRW present) ⁵
Primary COPCs			
²²⁶ Ra(Bq/g) ⁶	0.24	0.92	-
²³⁰ Th (Bq/g) ⁶	1.11	4.62	-
²³² Th (Bq/g) ⁶	0.103	0.343	-
Arsenic	20/25 ⁷	40/50 ⁷	40 ⁷
Antimony	13 ⁷	40/44	40(13) ⁹
Cobalt	40/50	80/100	80
Copper	225 (150)/300 (200)	225/300	225
Nickel	150/200	150/200	150
Uranium	35	76	76
Lead	200 ⁷	1000	1,000 (200) ⁹
Fluoride ⁸	N/A	2,000	N/A
Secondary COPCs			
Barium	750/1000	1500/2000	1,500 (750) ⁹
Beryllium	-	-	1.2
Boron	1.5	2.0	2.0
Cadmium	12 (3)/(4)	12	-
Mercury	10	10	10
Molybdenum	40 (5)	40	40 (20) ⁹
Selenium	10 (2)	10	10
Silver	20/25	40/45	40
Vanadium	200	200	200
Zinc	600/800	600/800	600

- ¹ Criteria expressed as incremental concentrations for radionuclides, total concentrations for other COPCs. Italicized values apply to medium and fine-grained soils only. Those not in italics apply to either all soils (where italicized values are absent) or to coarse soils. All four designated industrial waste-contaminated sites are known to have coarse soils.
- ² Concentrations as µg/g unless otherwise stated.
- ³ Lower values (in parentheses) represent MOE "Table 2" values for agricultural land use in potable groundwater situations, for use where applicable. Values not in parentheses are applicable to residential land uses (where values in parentheses are also listed) or to both residential and agricultural land uses. Italicized values in parentheses apply to medium and fine-grained agricultural land uses.
- ⁴ Concentrations higher than criteria listed may be acceptable at depths >1.5 m at the new LTWMFs.
- ⁵ Categorization of Primary and Secondary COPCs at industrial waste-contaminated sites differ from those for LLRW sites.
- ⁶ Summation rules apply to ²²⁶Ra, ²³⁰Th and ²³²Th, and also account for any dose contribution from uranium. Radionuclide Criteria represent incremental concentrations.
- ⁷ Alternate site-specific values may be appropriate for As, Sb and Pb in surficial soil, depending on site-specific conditions, as discussed in Section 4.4.3.3 and as detailed in EcoMetrix (2005).
- ⁸ Fluoride criterion based on CCME criterion for industrial land use, applicable at Port Granby WMF only where all fluoride-rich wastes are deposited.
- ⁹ Lower values applicable at John Street former Coal Gasification Plant site if clean-up is to meet residential land use. (Lower values indicated only for COPCs present at John Street site).

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The results of the analysis of the composite sample collected from this site are provided in Table 5-3. The COC and soil analysis results are provided in Appendix G and the results of the Ra-226 analyses conducted by the LLRWMO laboratory in Appendix H.

Table 5-3: Site [REDACTED] – Analytical Results for Soil Samples

Sample #	Sample Type	Depth (cm)	Soil Type	Date of Analysis	Primary COPCs									
					²²⁶ Ra (Bq/g)	²³⁰ Th (Bq/g)	²³² Th (Bq/g)	Arsenic (µg/g)	Antimony (µg/g)	Cobalt (µg/g)	Copper (µg/g)	Nickel (µg/g)	Uranium (µg/g)	Lead (µg/g)
					PHAI Clean-up Criteria									
					0.29	1.16	0.158	20	137	40/50	225/300	150/200	35	200
					Background Value									
					0.048		0.055	17	1	21	85	43	1.9/2.1	120
BH01 (05-Aug-2010)														
001	Composite	0-10	Topsoil	10-Aug-10	0.009	<0.2	0.005	1.68	1.71	4.1	3.68	12.9	0.795	13.1
		10-160	Sand											
		160-180	Clay with sand and Gravel											
EOH		180												

Sample #	Sample Type	Depth (cm)	Soil Type	Date of Analysis	Secondary COPCs									
					Barium (µg/g)	Beryllium (µg/g)	Boron (µg/g)	Cadmium (µg/g)	Mercury (µg/g)	Molybdenum (µg/g)	Selenium (µg/g)	Silver (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
					PHAI Clean-up Criteria									
					750/1000	-	1.5/120	12	10	40	10	20/25	200	600/800
					Background Value									
					210			1	0.23	2.5	1.9	0.42	91	160
BH01 (05-Aug-2010)														
001	Composite	0-10	Topsoil	10-Aug-10	413	0.815	9.68	<0.05	<0.05	0.254	<1	0.175	33.9	26.3
		10-160	Sand											
		160-180	Clay with sand and Gravel											
EOH		180												

Notes:

1. COPCs: Contaminants of Potential Concern and background values are defined by Port Hope Area Initiative Clean-up Criteria (see EcoMetrix 2006).
2. EOH: End of borehole.
3. Sample is a composite of soil from ground surface to end of borehole.
4. Radium-226 values measured by LLRWMO gamma spectrometry and all other parameters by Kinectrics ICP-MS.
5. Boron standards for all surface soils are 1.5 µg/g for hot water soluble extract. For subsurface soils the standards are 120 µg/g for total boron (mixed strong acid digest), as ecological criteria are not considered.
6. Italicized values apply to medium and fine-grained soils only. Those not in italics apply to either all soils (where italicized values are absent) or to coarse soils.
7. Bold and Highlighted values exceed COPC criteria.

All parameters, including the signature parameters (radium, thorium, uranium and arsenic), meet the PHAI CC.

In addition to the comparison to the PHAI CC, the analytical results were also compared to the “background” soil quality values (shown in Table 5-3). These concentration levels were also determined by EcoMetrix (December 2006), and are discussed in Section 4.3 of the *Port Hope Area Initiative Clean-up Criteria*. Barium and antimony exceed the background soil quality values.

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5.3.4 Verification Process

The MMM Group developed (May 2010) the *Remediation Verification Standard Operating Procedure* (RVSOP) for use in the PHAI (including the SRCA project) that describes a field applicable verification procedure for soil to confirm that:

- If soil contamination is suspected, the PHAI CC (as presented in the *Port Hope Area Initiative Cleanup Criteria*, Ecometrix 2006) have been achieved following soil remediation; or
- If soil contamination is not suspected, the PHAI CC is satisfied following the Final Verification Process for soil based on initial site characterization activities conducted during each property survey.

In the RVSOP, Figure 6.1 provides a general overview of the soil verification process. If soil results are less than the signature parameter criteria, then the Final Verification Process is undertaken.

For site [REDACTED] soil contamination is not suspected. Therefore, the Final Verification Process for sites without soil remediation (Section 6.3.3, Figure 6.12 in the RVSOP) is followed, as described below.

1. The RVSOP requires application of the Summation Rule for any site where more than one sample is collected. The summation rule is an approach that is used to ensure that all radioactive COPCs do not combine to result in a potential dose greater than the project dose constraint of 0.3 mSv per year to a member of the public. Since only one sample was collected, the Summation Rule is not applicable.
2. The concentration of COPC parameters in the composite soil sample collected at this site was determined by laboratory analysis. The results were compared to criteria, as per Sub-step 10a.SR3 of the RVSOP. As is indicated in Table 5-3, the analytical results for the composite soil sample collected at this site indicate that all COPC parameters, including the signature parameters, meet the PHAI CC.
3. The concentration of COPC parameters in the composite soil sample collected at this site were compared to background levels, as per Sub-step 10a.SR4 of the RVSOP. When following this step, it was found that the measured antimony and barium concentrations in the sample exceed the background value. All other COPC parameter concentrations, including the signature parameters, are below the background value.

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6.0 CONCLUSIONS

Site [REDACTED] meets the PHAI CC. Specific aspects of this investigation are described below:

1. The PHAI CC for objects and materials was met for both total and loose radiation on tested surfaces.
2. The PHAI CC for radon was met on both the main level and basement of the house.
3. The PHAI CC for COPCs in soil were met by the composite soil sample.

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7.0 ACKNOWLEDGEMENTS

SNC-Lavalin would like to acknowledge the LLRWMO for their assistance throughout the Small-Scale Sites Resurvey and Remediation Trials Cost Assessment project. The LLRWMO provided technical support in the planning and execution of the project based on their extensive knowledge in LLRW contamination resurvey and remediation work, as well as the direct input of their staff supporting operations in the field, calibrating resurvey equipment and providing radiological analysis of soil samples.

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8.0 REFERENCES

1. EcoMetrix Incorporated. 2006. *Port Hope Area Initiative Clean-up Criteria*. LLRWMO-01611-TE-11004, Revision 5.
2. LLRWMO, 2008. *Port Hope Project Environment and Protection Program*. 509200-MAN-12001, Rev 2.
3. Marshall Macklin Monaghan, 2008. *Port Hope Area Long-term, Low-Level Radioactive Waste Management Project Design Description, Volume 3, Waste Excavation Management Plan for Remediation Sites*, LLRWMO-01340-DD0-12001.
4. EcoMetrix Incorporated. 2008. *Port Hope Area Initiative (PHAI) Remediation Verification Protocol Guideline*. LLRWMO-12257-GL-12001, Revision 2.
5. Marshall Macklin Monaghan, 2010. *Remediation Verification Standard Operating Procedure*, Port Hope Project, prepared for Atomic Energy of Canada Limited.

Small-Scale Sites Resurvey and Remediation Trials Costs Assessment Project Procedures:

6. SNC Lavalin, 2010. *Environmental Management Plan*, 503107-0000-4EPA-0002 Rev 00.
7. SNC Lavalin, 2010. *Project Health and Safety Plan*, 503107-0000-4EPA-0003 Rev 00.
8. Kinectrics, 2010. *Radiation Protection Plan*, K-015367-RPP-001 Revision 00.

LLRWMO Field Service Operating Procedures:

9. LLRWMO-FS-OP-002, "Surficial Soil Sampling Using Oakfield Soil Sampler".
10. LLRWMO-FS-OP-006, "Preparation of Composite Soil Samples for Chemical Radionuclide Analysis".
11. LLRWMO-FS-OP-031, "Contamination Check of Equipment and Personnel".
12. LLRWMO-FS-OP-034, "Chain of Custody for the Relinquishment of Environmental Samples".
13. LLRWMO-FS-OP-050, "Taking Measurements with a Contamination Meter".

DOCUMENT END

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NOTICE TO READERS

1. The Property Survey work performed in this report was carried out in accordance with the terms and conditions made part of our proposal and/or contract pursuant to which the report was issued. The results and conclusions presented in this report are based solely upon the scope of services, governed by the time and budgetary considerations to which this work was subject.

2. The principles, procedures and standards applied in conducting a Property Survey are neither regulated nor universally the same. The work has been carried out in accordance with generally accepted practices and industry standards and regarding applicable environmental regulations for environmental studies/investigations. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report.

3. The bore hole and hand auger logs indicate the approximate subsurface stratigraphy and conditions only at the locations of the bore and hand auger holes. Soil and rock formations are variable to a greater or lesser extent. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface stratigraphy and conditions are indicated depends on the method of boring, the frequency of sampling, the method of sampling and the uniformity of subsurface stratigraphy and conditions. Subsurface stratigraphy and conditions between bore and auger holes is inferred and may vary significantly from stratigraphy and conditions encountered at these holes.

4. The Property Survey presented in this report is based on interpretation of conditions determined at specific sampling locations and depths. The levels of contamination are determined based on the results of the radiological resurvey and chemical analyses on a given number of soil samples obtained at the place and time of observation/investigation noted in this report. The nature and degree of contamination between the points of sampling may vary significantly from conditions encountered at the test locations. These conditions may also vary seasonally or as a consequence of activities on the site or adjacent sites which are beyond the control of SNC-Lavalin Inc.. While the work carried out has been aimed at minimizing the risk of unidentified environmental problems or concerns, there is no assurance, nor does SNC-Lavalin Inc. warrant either expressly or by inference, that other occurrences of radiological contamination or contaminated soil do not exist on site.

5. Groundwater elevations and conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary seasonally or as a consequence of construction activities on the site or adjacent sites.

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6. The list of parameters tested in the laboratory is based on the scope of work prescribed by the client. The fact that other parameters were not analyzed does not exclude the possibility that these contaminants may be present at a concentration above background level, or detection limit.
7. The conclusions reached by this report are based only on the locations investigated and cannot be extended to other parts of the site or other sites which might have been unavailable for inspection or investigation at the time of the work, whether by result of equipment access or hidden by coverings (natural or man-made) or existing structures.
8. The Property Survey report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence.
9. This Property Survey report does not form a legal opinion. The disclosure of any information contained in this report is the sole responsibility of the client. Any use, reliance or decisions made on the basis of this report by any third party are totally the responsibility of any third party. SNC-Lavalin Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report.

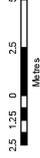
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LEGEND

- ⊕ BOREHOLE LOCATION
- ▭ SITE PROPERTY BOUNDARY (APPROX.)



AIR PHOTOGRAPHY, 2006

ID	DATE	ESKED WITH FINAL REPORT	REVISION	BY	CHK	APP



Client
 Project
 Small-Scale Sites Resurvey and Remediation Trials Cost Assessment (SRCA)

Title

Scale	1:250	Drawn	D.M.L.	Date	APR 2011
Approval					
Designed					
Checked					
Approved					
BASE MAP WITH BOREHOLE LOCATION				Figure No.	1
				Rev.	00

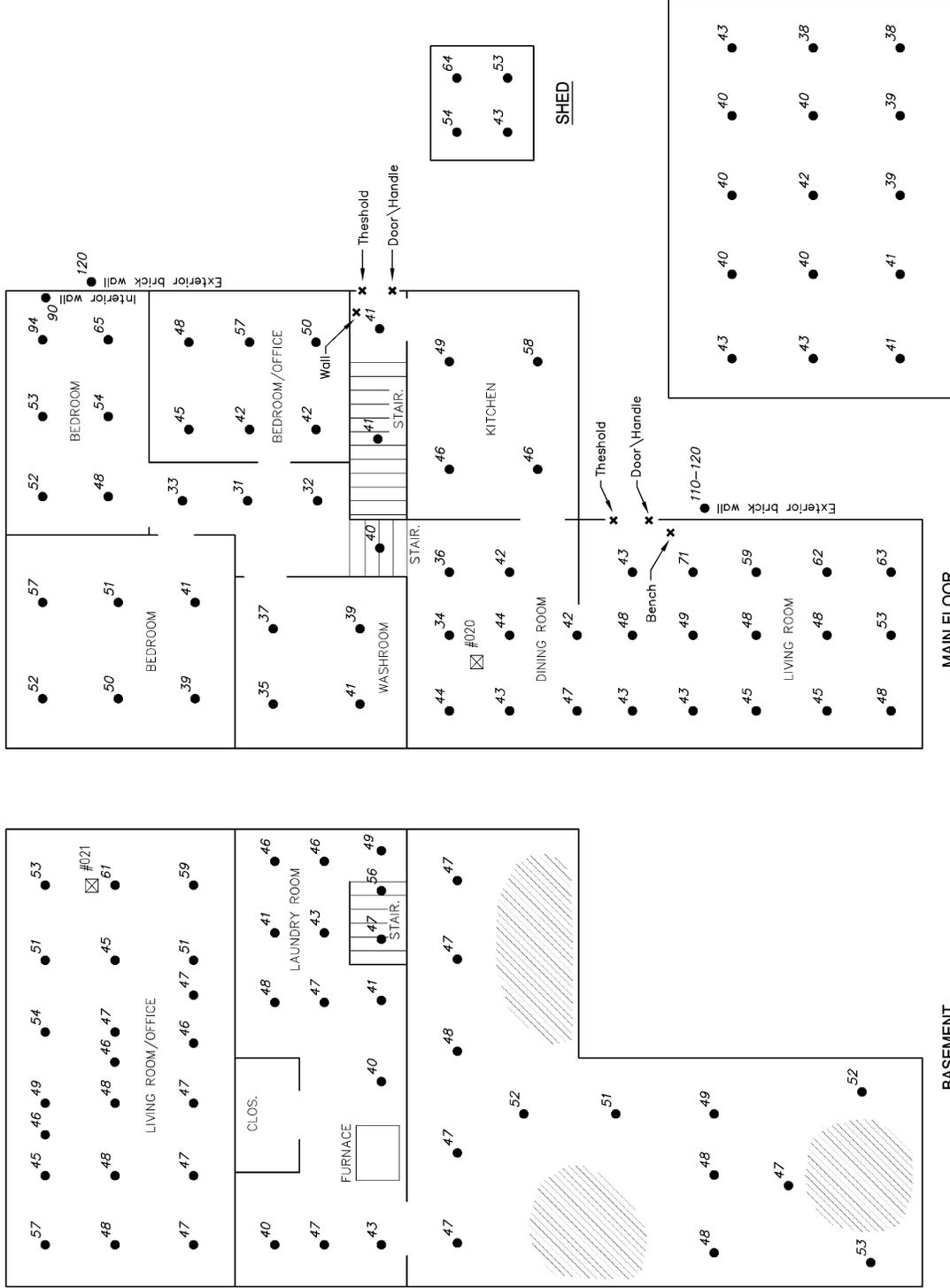
FILENAME: H:\03107\444\AESC\001.MXD 11/04/08

LEGEND

- 45 INTERIOR GAMMA RADIATION READING (nSv/h)
- ✕ TOTAL SURFACE CONTAMINATION READING LOCATION
- ☒ RADON DETECTOR
- ▨ INACCESSIBLE AREA

NOTES

SEE GENERAL INTERNAL GAMMA SURVEY DATA FORM FOR ADDITIONAL DETAILS OF GAMMA SURVEY (SEE REPORT APPENDICES).



MAIN FLOOR

BASEMENT

WOOD SHOP

INTERIOR GAMMA RADIATION SURVEY READINGS

Scale	1:72 (approx.)	Drawn	Date	APR. 2011
Approval	Incl.	Date	Rev.	
Designed	11/04/08	11/04/08	Figure No.	2
Checked	11/04/08	11/04/08	Figure No.	2
Approved	11/04/08	11/04/08	Figure No.	2



Client: SNC-Lavalin
 Project: Small-Scale Sites Resurvey and Remediation Trials Cost Assessment (SRCA)

No.	DATE	ISSUED WITH FINAL REPORT	REVISION	BY	CHK./APP.

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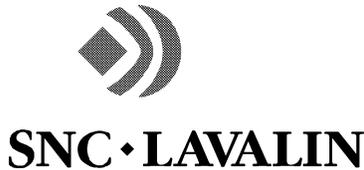
Appendix A

Consent Form and Communication Notices

AECL

Port Hope Area Initiative Management Office

Property Survey Access Consent Form		Port Hope Area Initiative Management Office 5 Mill Street South Port Hope, Ontario, L1A 2S6 Ph: (905) 885-0291 Fax: (905) 885-9344	
LLRWMO File No. 2185-		PHAI File No. 4501-121250-110-000	
Property Address			
Street Name & Number:	[REDACTED]		
Municipality:	Port Hope		
Province:	Ontario	Postal Code:	L1A [REDACTED]
Property Owner's Name(s):	[REDACTED]		Phone #: [REDACTED]
Email Address:	[REDACTED]		
Property Owner Mailing Address (if different from above)			
Street Name & Number:	[REDACTED]		
Municipality:	[REDACTED]		
Province:	[REDACTED]	Postal Code:	[REDACTED]
Please check the appropriate boxes.			
<input checked="" type="checkbox"/>	I am (we are) the Property Owner(s).		
<input type="checkbox"/>	I have ensured all residents and/or tenants are aware of this Access Agreement.		
<input type="checkbox"/>	I am acting on behalf of the Property Owner with the Owner's permission attached in writing.		
I allow access to the property by AECL personnel or by authorized persons working on behalf of AECL for the purpose of conducting surveys and detailed investigations for the identification of contaminants that may require removal under the PHAI clean-up criteria. Such investigations may entail drilling exterior boreholes, collection of soil samples, interior/exterior contamination surveys and interior radon gas sample collection.			
AECL will leave the property in the same state as it was prior to the survey, to the extent practicable.			
Arrangements for access will be made verbally and in advance of any on-site investigations.			
Owner's Name (Printed):	[REDACTED]	Owner's Name (Printed):	[REDACTED]
Signature:	[REDACTED]	Signature:	[REDACTED]
Date:	June 29/10	Date:	[REDACTED]
AECL Representative (Printed):	[REDACTED]	SUZANNE STICKLEY	
Signature:	[REDACTED]	Date:	June 29/10
Except for personal information, all information collected as part of the surveys/investigations will be the property of AECL. It is anticipated that the information will be available to third parties, as part of the PHAI Port Hope project.			
Personal information collected on this form is protected under the federal Privacy Act and will be used to allow access to your property for the purpose of conducting surveys and investigations. Failure to provide the information may have an impact on the Property Resurvey project status. Please contact the Port Hope Area Initiative Management Office or the Coordinator, Access to Information and Privacy at AECL (www.aecl.ca/contact/access), in the event you would like access your personal information. Full details regarding this collection of information are available at Info Source (www.infosource.gc.ca/index-eng.asp) by referring to "Institute-Specific Personal Information Bank AECL PPU 007."			



SNC•LAVALIN Inc.
400 Carlingview Drive
Toronto, Ontario
Canada M9W 6N9

Telephone: 416-679-6000
Fax: 416-231-5356

July 13, 2010

Port Hope Area Initiative Small Site Resurvey Program

Thank you for your participation in the Port Hope Area Initiative Small Sites Resurvey Program. The first stage of the resurvey of your home and property has been scheduled for:

TIME 1:00 PM **DATE** Tuesday, July 20, 2010

We request that a member of the household be present during the first stage of the resurvey, which should take approximately 4 hours. Personnel conducting surveys will be identified with Port Hope Area Initiative name tags. If you are unavailable for the scheduled appointment, please contact SNC Lavalin at 1-888-679-6291 as soon as possible to reschedule.

Indoor and outdoor radiation surveys will be performed, which will require access to all rooms of your home and areas of your property. Also, we will be installing radon monitors, which we will be returning to remove within 5 to 8 days after our initial visit. To assist us in completion of the resurvey work, we ask that you follow these guidelines:

- Outdoor surveys will involve the use of a wheeled trolley. Where possible, please clear yard of objects, or mow tall grass, which may impede use of this trolley.
- For the convenience of our staff, please keep pets and children away from areas and rooms being surveyed.
- Cars should be parked on the street to allow surveying of the driveway and garages/ carports.
- During the 5 to 8 days while the radon monitor is in place, normal house conditions should be maintained to the extent possible.
 - If you have a radon abatement system, please continue to operate normally during the measurement period.
 - Air conditioning systems that recycle interior air can operate normally during the measurement period.
- Detectors should not be touched, moved, or manipulated in any way as to interfere with their performance.

The second stage of the resurvey work will involve drilling one to three small boreholes in your yard to obtain soil samples. We will contact you to arrange for a convenient time for this work, although you will not be required to be present during the drilling.

If you have any concerns other than scheduling, the Port Hope Area Project Information Exchange can be contacted at (905) 885-0291 (Sue Stickley, Communications Officer).



AECL
Atomic Energy
of Canada Limited

EACL
Énergie atomique
du Canada limitée

Information



PORT HOPE AREA
INITIATIVE

July 2010

For your information

Subject: Local Site Visit Work in Support of the Port Hope Project

The Port Hope Area Initiative is responsible for the cleanup and safe management of historic low-level radioactive waste in Port Hope and Clarington for the long-term. Under the Port Hope Project waste will be removed from its current locations (remediated) and transferred to a new secure above-ground management facility to be constructed on the site of the current Welcome Waste Management Facility.

Property visits, radiological surveys and cleanup work in the Municipality of Port Hope are part of the Small Scale Site Resurvey and Remediation Trials Cost Assessment. This pilot project involves about 35 candidate sites at various locations in Port Hope. The firm of SNC Lavalin has been retained to undertake this work.

If you have any questions regarding this work in support of the Port Hope Area Initiative, please contact the Port Hope Project Information Exchange at 115 Toronto Road (905) 885-0291. For up-to-date project information, please visit our website at www.phai.ca

Thank you for your interest


Suzanne Stickley
Communications Officer

PORT HOPE AREA INITIATIVE MANAGEMENT OFFICE

P.S. IN YOUR NEIGHBOURHOOD ON

Monday, July 12, 2010

Canada

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Appendix B

Legal Survey

PLAN SHOWING

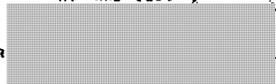


TOWN OF PORT HOPE

Scale - 1 in. = 30 ft.

JOHN L. SYLVESTER LIMITED
17 ONTARIO STREET PORT HOPE, ONT.
416-485-2260

PER

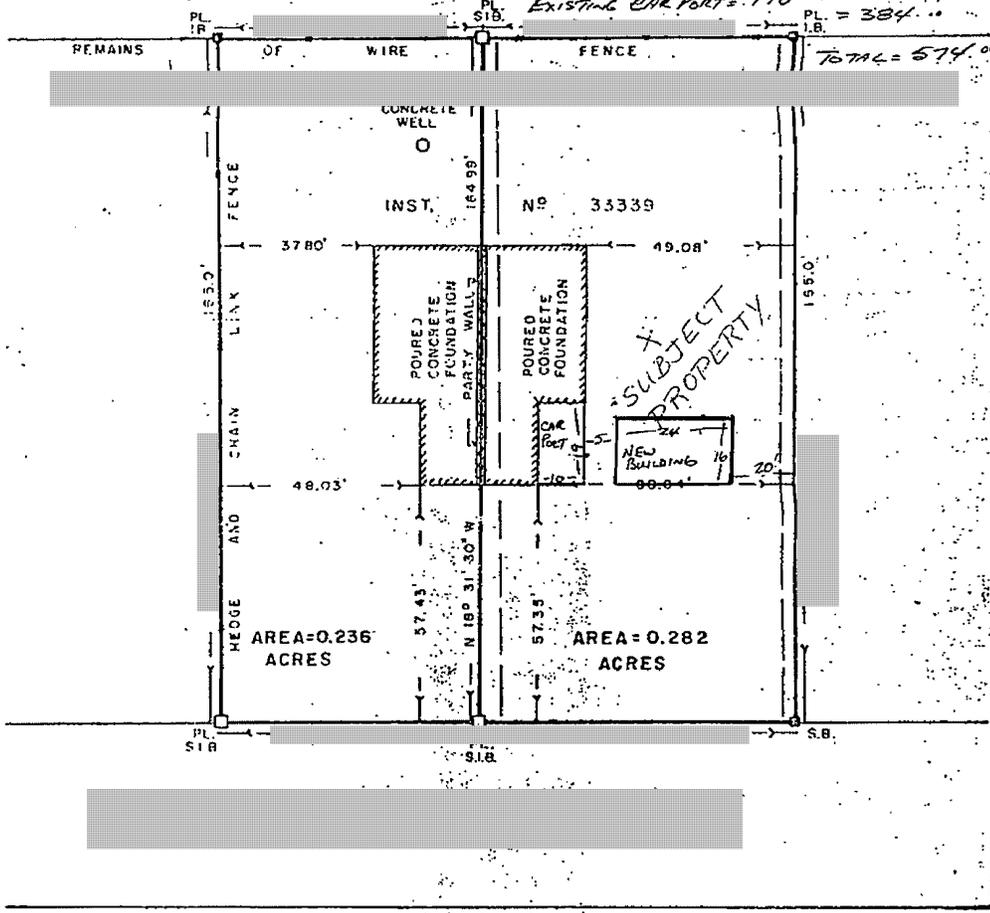


73005 31 JANUARY 1973



THIS PLAN PREPARED FOR MORTGAGE PURPOSES.

Total Sq Ft = 12145.65
5% = 607.28
EXISTING CAR PORT = 190.° NEW BUILDING
PL. = 334.°



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Appendix C

Historical File Review

File Review

s.19(1)

July 6, 2010

Duplex building.
Area: 0.282 acres

Feb.25/76 Record of Radiation Survey:
Radon sample requested: (Franck real estate)
Inside house maximum reading: 0.007 mR/h.
Yard: 0.004-0.009 mR/h.
Bricks scattered throughout walls: 0.010 mR/h.

March 25/76 Port Hope Radiation Survey:
Initial radon (living or work area): 0.2 pCi/l.
Initial radon (basement) 0.3 pCi/l.

Feb.26 /76 Indoor Gamma Radiation Survey Data:
Max. Gamma field found indoors: 0.007 mR/h.
Most common gamma field found indoors: 0.010 mR/h
Outdoor Gamma Radiation Surveys:
Max. reading for all spots: 0.070 mR/h.

March 25/76
The concentrations of radon measured were done by the Community Health Division:
0.3 picocurie of radon-222 per litre of air on March 9, 1976 in the middle basement.
0.2 picocurie of radon-222 per litre of air on March 9, 1976 in the living room.
Since within normal range, no further samplings were done.

July 27/76 Record of Radiation Survey:
Surveyor's comment: yard background: 0.010-0.015 mR/h.
A plan with exterior survey results shows the scan ranging from 0.010 to 0.015 mR/h.
The plan indicates that the scan's result for the shed on the east side of the property is 0.09 mR/h. It appears the result was rechecked on Aug.27/76 and was 0.2 mR/h on the old bricks of the cement wall.

Sept. 29 /2000- Survey due to the new workshop adjacent and east of the shed:
Area northeast of the shed: 5-6.7 uR/h.
Area southeast of the shed: 4-6.6 uR/h.
Workshop area east of the shed: 5-6.6 uR/h.

Issues to investigate:
Make sure that the old brick have been removed.

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Appendix D

Kinectrics Field Data Collection Forms and Satisfaction Survey

TEST SITE

Name: [redacted]
 Home Address: [redacted]
 City, Province: Port Hope, ON

Time in: 13:00
 Time out: 15:30
 s.19(1) Verified by: [redacted]

TEST DATES

Start Date: 20-July-2010 Start Time: 13:15 Deployed By: [redacted]
(dd-mm-yyyy) (hh:mm)

DETECTOR INFORMATION

Electret #	Box #	Room Deployed	Location in Room	Background Gamma	Comments
SFM 320	021	Basement - office/living rm	on a cabinet	61 nSv/hr	N/A
SFM 390					
SFH 529	020	Dinning room/ Living room	on a dinning table	44 nSv/hr	N/A
SFI 366					

Digital photograph taken of each detector (i.e. Box) location? **YES** or NO

If **YES** - specify camera and file name for each Box below

If **NO** - draw the sketch of each Box location below

Box # 021

 Camera #1, pic # 0278

Box # 020

 Camera #1, pic # 0279

TEST SITE INFORMATION

General House Information

House Type: semidetached, split level **BASEMENT** or SLAB ON GRADE or **CRAWL SPACE**
 Finished or Unfinished Basement? **FINISHED** or UNFINISHED
 Walkout Basement? **YES** or **NO**
 Central HVAC System **YES** or NO
 Thermostat Set At: 74F

Protocols

Closed House Conditions During Testing Period? **YES** or NO or **NOT MONITORED**

Tamper Controls

Tamper Indicating Controls Used? **YES** or NO

Description of Tamper Controls: lock ties
4 tamper tape

GENERAL INTERNAL GAMMA SURVEY DATA FORM

Site No. [REDACTED]

TEST SITE

Date (YY/MM/DD): 10-07-20
 Time start: 13:30
 Time finish: 15:00
 Surveyor: [REDACTED]

s.19(1)

EQUIPMENT

DETECTOR MODEL: FHZ 672 E-10 NBR

Serial Number of Detector (Circle One): 759 760 764

detector: 0650

Serial Number of Rate Meter (Circle One): 23451 19425 23623 23601

rate meter: 23451

INSTRUMENT CHECK "Pass" if within required reading range.

SOURCE: Co-60
 Required reading: 2 ± 0.5 uSv/h
 Actual reading: 1.83
 Circle One: Pass Fail

*Ra-226
 130cps ± 25%
 150
pass fail*

PHOTOGRAPHS

Camera Number: (Circle One) 1 2 File Start Number: 0278
 Memory Card Number: (Circle One) 1 2 3 4 File End Number: 0294
 Verify Camera Date/Time:

SURVEY

Minimum Coverage: 1m x 1m

	Complete / NA	Calculate # Survey Locations	Survey Complete	Identify High Values
Floor plan of basement:	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <u>35</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Floor plan of main floor:	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <u>30</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Floor plan of second floor:	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <u>26</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Floor plan of crawl space:	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <u>13</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Floor plan of _____:	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> _____	<input type="checkbox"/>	<input type="checkbox"/>

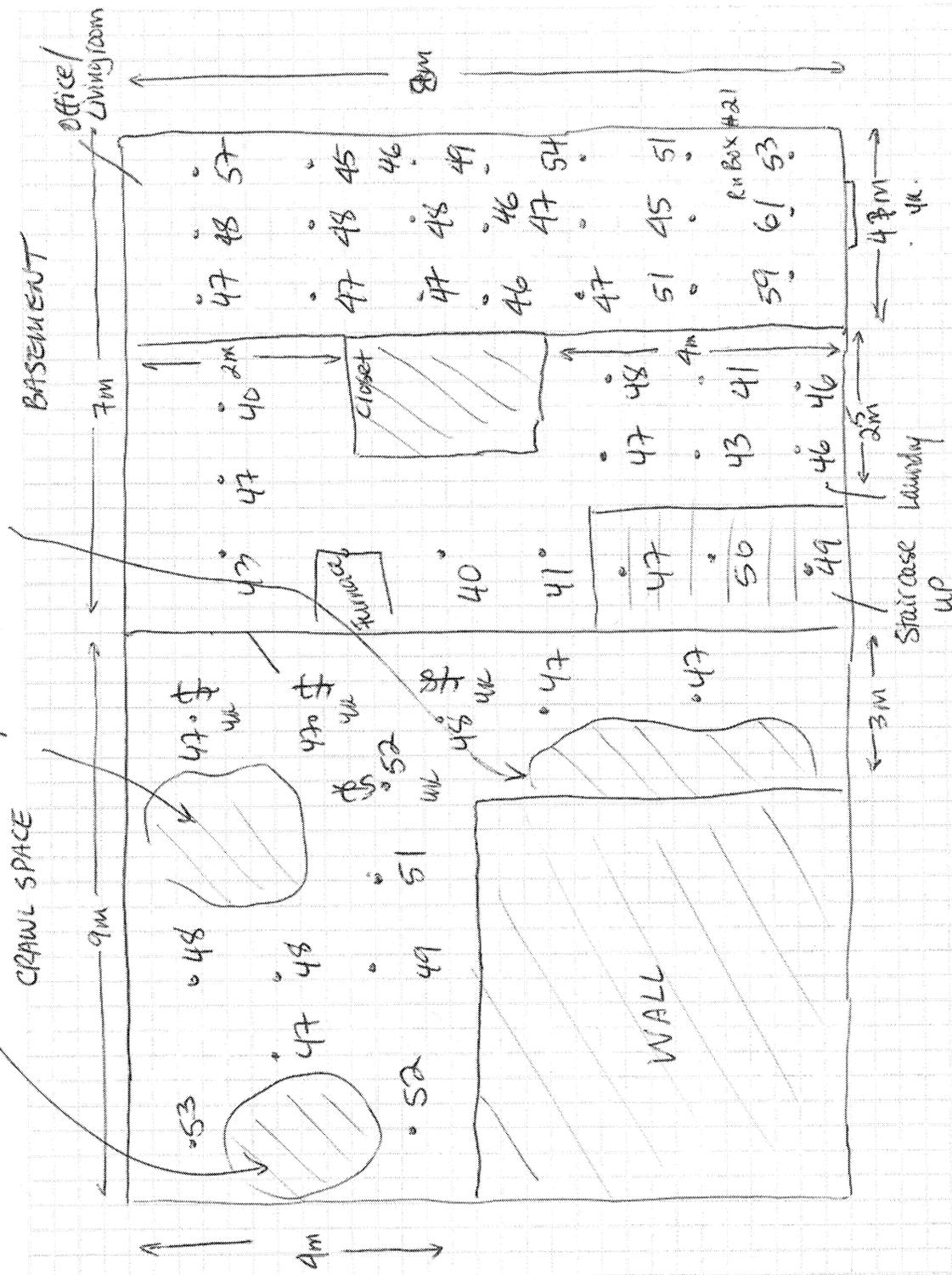
Site No: [REDACTED]

Description Basement and Crawl Space

Date (YY/MM/DD) 10-07-20

Surveyor [REDACTED]

partially inaccessible areas - owner's belongings.
PIC# 0285

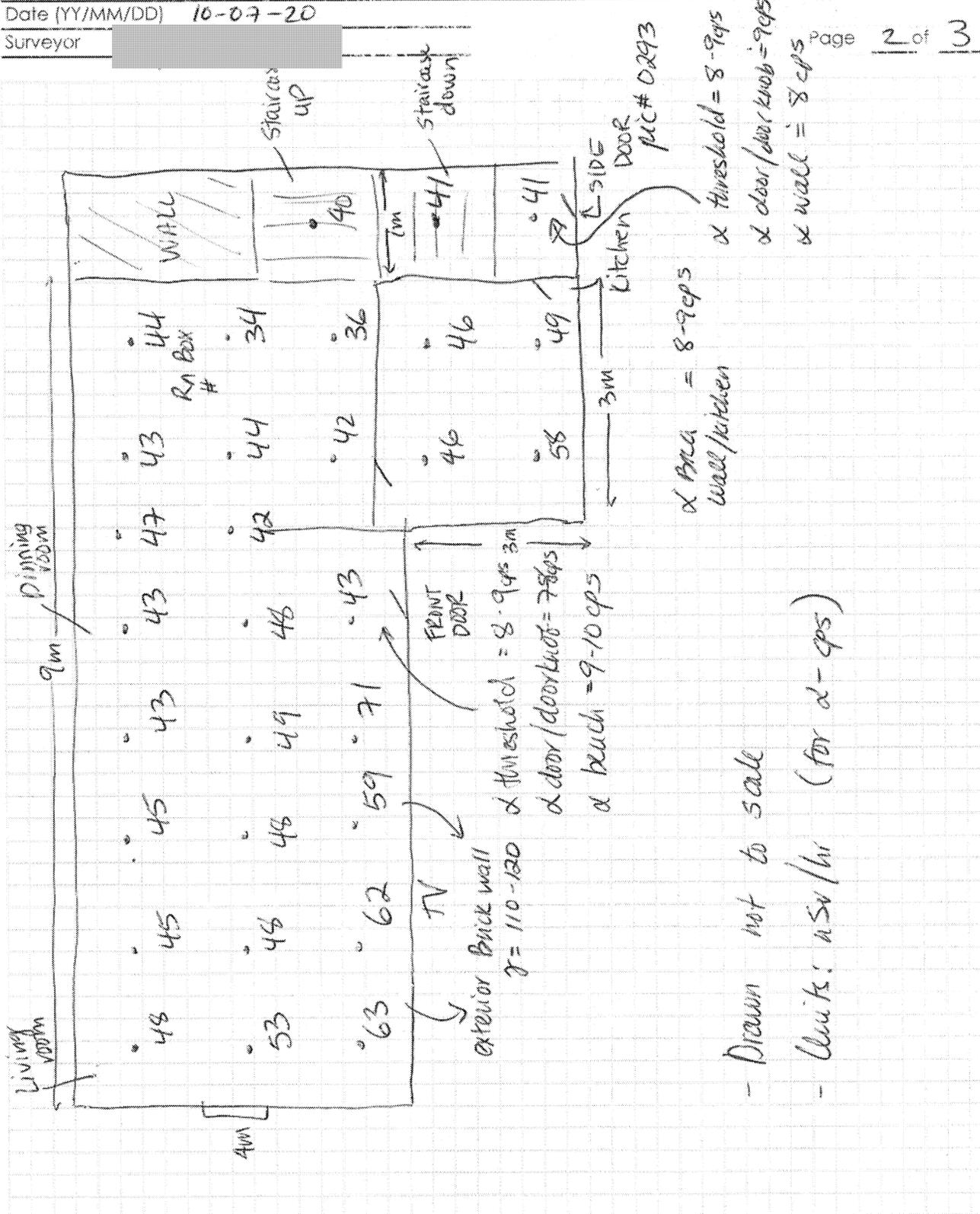


Site No: [REDACTED]

Description Main Floor

Date (YY/MM/DD) 10-07-20

Surveyor [REDACTED]



GENERAL EXTERNAL GAMMA SURVEY DATA FORM

TEST SITE

Date (YY/MM/DD): 10/07/20

Time start: 1:00 PM

Time finish: 3:30 PM

Surveyor: _____ s.19(1)

CREATED DATA FILES

GPS File Name: _____

Dose Rate File Name: _____

EQUIPMENT

DETECTOR MODEL: FHZ 672 E-10 NBR

SN of Lower Detector (Circle One): 759 760 764
SN of Left Rate meter (Circle One): 23451 19425 23623 23601 022459

SN of Upper Detector (Circle One): 759 760 764
SN of Right Rate meter (Circle One): 23451 19425 23623 23601

INSTRUMENT CHECK "Pass" if within required reading range.

SOURCE:	Co-60	Co-60
	Lower Detector	Upper Detector
Required reading:	<u>2 ± 0.5 uSv/h</u>	<u>2 ± 0.5 uSv/h</u>
Actual reading:	<u>1.8 uSv/h</u>	<u>1.8 uSv/h</u>
Circle One:	<u>Pass</u> Fail	<u>Pass</u> Fail

PHOTOGRAPHS

Camera Number: (Circle One) 1 2 File Start Number: 0030

Memory Card Number: (Circle One) 1 2 3 4 File End Number: 0037

Verify Camera Date/Time:

*camera #1 pic# 0294
Mcard#1*

SURVEY

	Sketch	Survey	
General site:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Exceptions:			
SN of Hand Held Detector (Circle One):	759	760	<u>764</u>
SN of Rate Meter (Circle One):	<u>23451</u>	19425	23623 23601
	Sketch	Survey	Identify High Readings
Inaccessible areas:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Unique site features:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

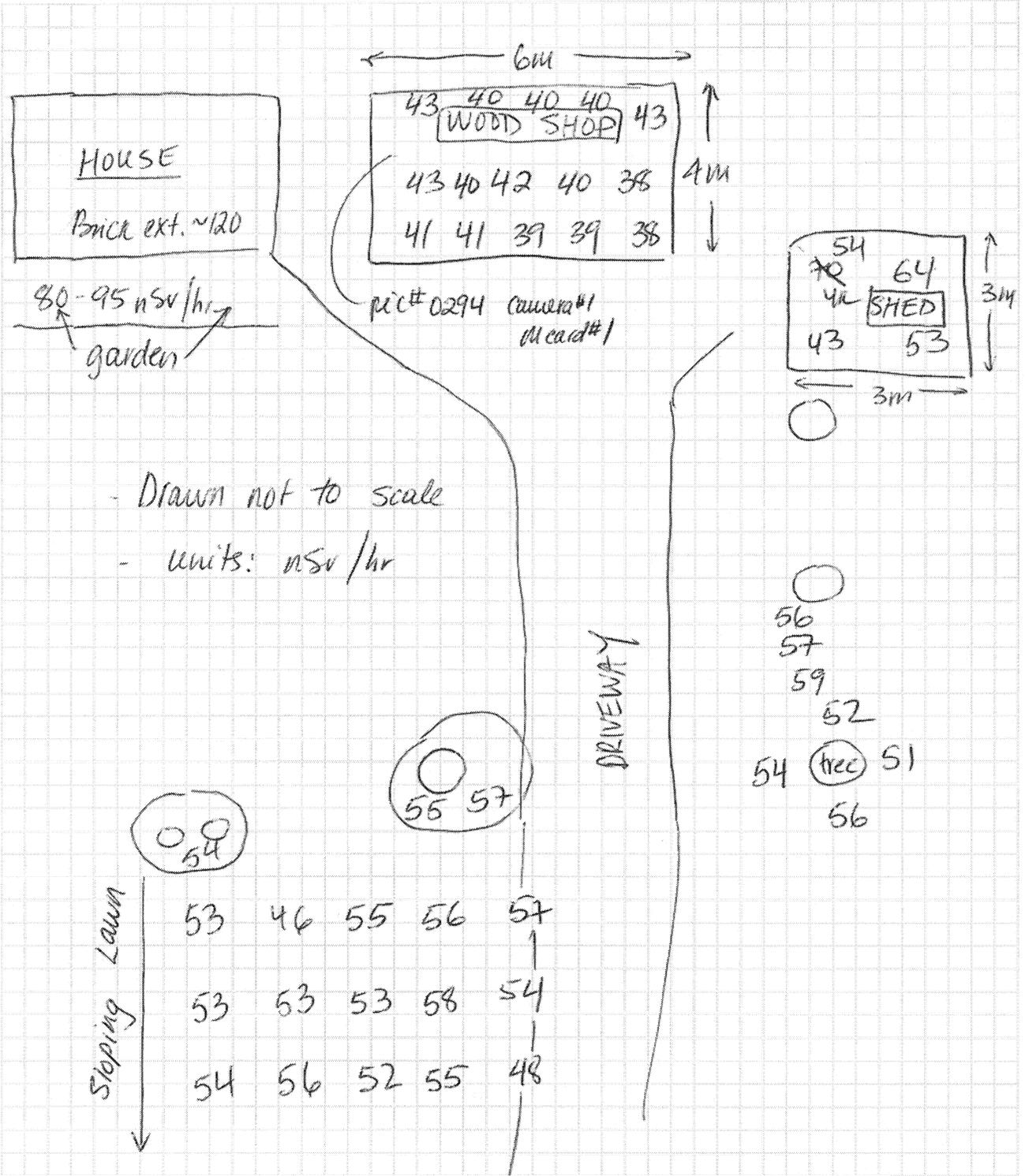
K-015367-SITEPLAN

Site No: [REDACTED]

Description Front Yard + Wood Shop + Shed

Date (YY/MM/DD) 10-07-20

Surveyor [REDACTED]



- Drawn not to scale
 - units: nsv/hr



SNC • LAVALIN

SNC • LAVALIN Inc.
400 Carlingview Drive
Toronto, Ontario
Canada M9W 6N9

Telephone: 416-679-6000
Fax: 416-231-5356

**Port Hope Area Initiative Small Site Resurvey Program
Customer Satisfaction Survey**

Thank you for your participation in the Port Hope Area Initiative Small Sites Resurvey Program. We appreciate your feedback so that we can improve our services. Please complete this survey and return to the project staff at the end of the scheduled resurvey work.

The resurvey staff arrived at the specified time and completed the work within a reasonable length of time.

Disagree Strongly 1 2 3 4 5 Agree Strongly

The resurvey staff were polite and were able to answer all of my questions, or direct me to someone who could answer my questions.

Disagree Strongly 1 2 3 4 5 Agree Strongly

I have been provided with adequate information regarding all steps of the resurvey program.

Disagree Strongly 1 2 3 4 5 Agree Strongly

After the survey, my home and property were left in the same condition as before the survey.

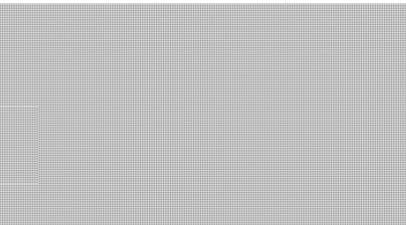
Disagree Strongly 1 2 3 4 5 Agree Strongly

Overall I am satisfied with the resurvey work that took place in my home / on my property today.

Disagree Strongly 1 2 3 4 5 Agree Strongly

Additional comments: _____

s.19(1)

Surveyors Name: 
SIGNATURE: 

Date / Time of Survey: 20-July-2010, 13:00

ADDRESS: 



AEOL
Atomic Energy
of Canada Limited

EACL
Énergie atomique
du Canada limitée

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Appendix E

Borehole Stratigraphic Log and Down-hole Gamma Radiation Log

FIELD DRILLING PROGRAM	SRCA Program	BH ID <u>BH01</u> PAGE 1 OF <u>1</u>
-------------------------------	---------------------	---

SITE ID <u> </u> DATE <u>Aug 5/10</u> SLI SUPERVISOR <u> </u> ARRIVAL TIME <u>8:00</u> DEPART. TIME <u>10:30</u> DRILLING TIME: START <u>9:00</u> END <u>9:30</u> SAMPLING TIME: START <u>9:45</u> END <u>10:20</u> WEATHER <u>(SUN) RAIN</u> TEMP <u>30°</u> NORTHING <u> </u> EASTING <u> </u> GENERAL LOCATION <u>BACK YARD, ON BIG SLOPE, LEFT OF TREE, JUST IN FRONT OF KENEL</u>	DRILLING CONTRACTOR <u>STRATA SOIL SAMPLING</u> DRILLING EQUIPMENT <u>GEOPROBE 420M</u> CREW <u> </u> BOREHOLE DIAMETER <u>2-1/4 inch</u> <u>3-1/4 inch</u> KINECTRICS STAFF <u> </u> GAMMA TOOL <u>FHZ-512A</u>
---	---

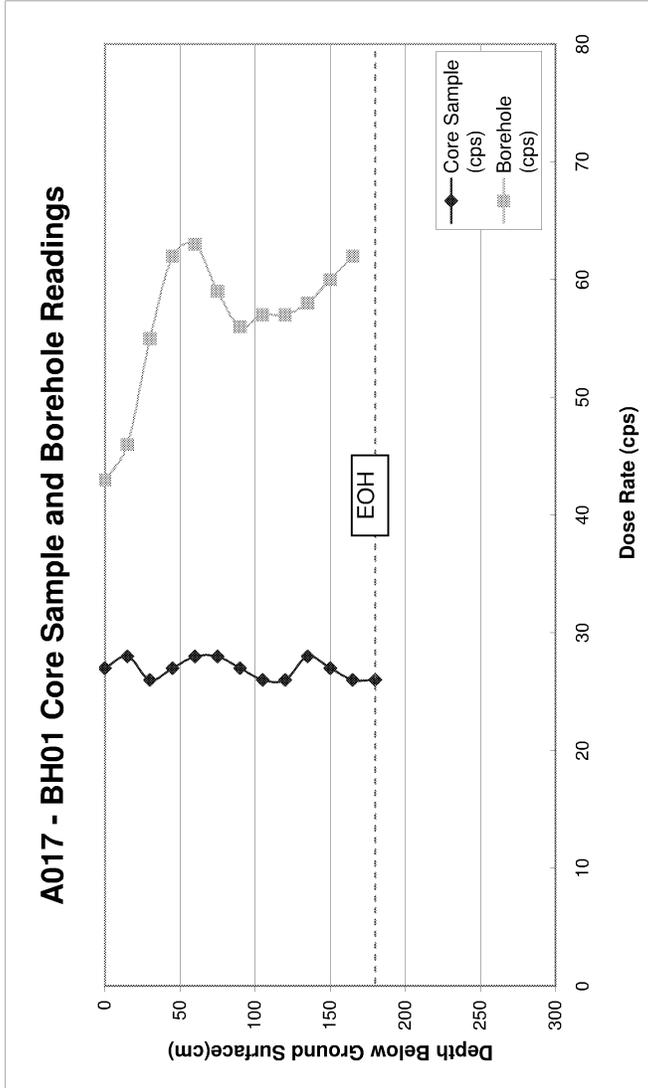
DEPTH	SAMPLES				SAMPLE DESCRIPTION <small>Colour, Density, Moisture, Grain size, Layering, Seams, Water encountered, Other comments, etc.</small>	GAMMA READING			
	No.	Recovery	Analyse	Hold		(cm) Depth	(cpm) Frisker	FHZ-512A (cps)	
								Surface	Downhole
0-0.6	1	100%			(0-10) TOPSOIL, GRASS, DARK BROWN LOOSE, DRY	0	110	27	43
					(10-140) GREY, DENSE, DRY, MED TO FINE GRAINED SAND	15		28	46
					(100-180) MED GRAY, DENSE, FINE PLAYSAND WITH SAND AND GRANUL	30		26	55
0.5 m						45		21	62
0.6-1.80(120)	2	100%				60		28	63
						75		28	59
						90		27	56
1 m						105		26	57
						120		26	57
						135		28	58
1.5 m						150		27	60
						165		26	62
					COH @ 1.80 DRILLING STOPPED DUE TO NATIVE SOILS REACHED	180		26	
2 m						195			
						210			
						225			
2.5 m						240			
						255			
						270			
						285			
						300			
3 m									

Site No.
Chart Title

BH01
BH01 Core Sample and Borehole Readings

Depth (cm)	Frisker (cpm)	Core Sample (cps)	Borehole (cps)
0	110	27	43
15	110	28	46
30	110	26	55
45	110	27	62
60	110	28	63
75	110	28	59
90	110	27	56
105	110	26	57
120	110	26	57
135	110	28	58
150	110	27	60
165	110	26	62
180	110	26	
195			
210			
225			
240			
255			
270			
285			
300			

EOH



EOH - End of Hole

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Appendix F

Results of Radon Measurements

SITE NO

RADON LAB ANALYSIS WORKSHEET

SITE INFORMATION

Name of Owner
Address
Address

Port Hope ON

QUALITY CONTROL DATA

SPER-E1 Reader No. E0324

Voltage Reader Calibration Check:

Date	RE3945	RE4076	ZERO
18-07-2010	254	260	0
25-07-2010	253	260	0

Reading Conditions:

	Initial	Final
Date	19-07-2010	26-07-2010
Temp (C)	24.1	24.5
Humidity	47%	39%

DEPLOYMENT INFORMATION

Start Test 20-07-2010 13:15
(dd/mm/yyyy hh:mm)

Finish Test 26-07-2010 12:25
(dd/mm/yyyy hh:mm)

Exposure Time (d) 5.97

TEST ANALYSIS

Electret No.	Box No.	Test Location	Gamma (nSv/h)	Initial Volts	Final Volts	CF	Bq/m3	(+/-) Bq/m3	Analyst
SFM320	021	Basement	61	632	613	2.055	37.7	3.4	YK
SFM390				652	630	2.066	46.4	3.8	
SFH529	020	Dining room	44	660	640	2.071	45.7	3.9	YK
SFI366				708	690	2.099	39.0	3.6	

REPORTED TEST RESULTS:

Average Radon Concentration in the Basement	42.1	Bq/m3
Relative % Difference (RPD)	21%	
Average Radon Concentration in the Dining room	42.4	Bq/m3
Relative % Difference (RPD)	16%	
Average Radon Concentration in the House	42.2	Bq/m3
Relative % Difference (RPD)	1%	

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<h2 style="margin: 0;">Appendix G</h2> <h1 style="margin: 0;">Chain of Custody and Results of Soil Analyses</h1>
--

PH 0043

PROJECT : Port Hope Soils

Telephone: 416-207-5550
Fax: [REDACTED]
Manager cell: [REDACTED]
Manager Pager: [REDACTED]

Lab Project Contact: [REDACTED]
In no event shall Kinectrics be liable for damages of any kind provided that the testing services are performed with standard professional care as accepted in the industry and as consistent with Kinectrics' corporate quality programs.

Phone: 416-207-6000 Fax: (416) 207-6094
Cellular: [REDACTED] Pager: [REDACTED]
e-mail: [REDACTED]@kinectrics.com

PO# or CREDIT CARD# N-015367-004 0020

Note: Submitter receives e-mail confirmations and invoices, hence must be the PO holder or approver.

KINECTRICS INC.
Analytical and Environmental Services
800 Kipling Avenue, KJ135, Unit 2, Toronto, Ontario M8Z 6C4
Radioactive Samples to KJ122
Contact: [REDACTED]

Client: Name: [REDACTED] Title: s.19(1)
Department: [REDACTED]
Address 1: [REDACTED]
Address 2: [REDACTED]

CHAIN OF CUSTODY RECORD

SPECIAL INSTRUCTIONS OR NOTES

Metals required: As, Sb, Co, Cu, Ni, U, Pb, Ba, Be, Cd, Hg, Mo, Se, Ag, V, Zn, Ra-226, Th-230, Th-232.

Analysis Required TAT (Turnaround Time)

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Some Exceptions Apply, Please Contact Lab
STANDARD 10 Business Days
RUSH Specify Date: 48 hour turnaround from receipt of sample

SAMPLING LOCATION: [REDACTED]

Metals - see special notes

Sample #	Sample ID or NAME (Description will appear on report)	Date Sampled	Time Sampled	Sample Matrix	No. of Containers	Comments
1	[REDACTED] - 6H01 ✓	AUG 5/10	9:45	soil	1	
2				soil	1	
3				soil	1	
4				soil	1	
5				soil	1	
6				soil	1	
7				soil	1	
8				soil	1	
9				soil	1	
10				soil	1	

RECEIVED
AUG 09 2010
ANALYTICAL & ENVIRONMENTAL CHEMISTRY LABORATORY

COPY 1: NAME: [REDACTED] **E-MAIL:** [REDACTED] **FAX#:** [REDACTED]

COPY 2: NAME: [REDACTED] **E-MAIL:** [REDACTED] **FAX#:** [REDACTED]

Samples Relinquished to Kinectrics by: [REDACTED] Date: AUG 6/10 Time: 7:00

Samples received in Lab by: [REDACTED] Date: AUG 6/10 Time: 7:00

SAMPLING PERFORMED BY: SNC LAVALIN

Method of Shipment: SNC LAVALIN.COM
Condition of samples upon receipt at lab: [REDACTED]

COURIER HAND DELIVERED RADIOACTIVE OTHER



KINECTRICS

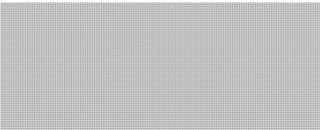
Printed - 17-Aug-2010
 Logged - 09-Aug-2010
 Approved - 16-Aug-2010
 Page 1 of 2

Analytical and Environmental Services Report: 10-PH0043

SNC Lavalin Inc.
 400 Carlingview Drive, Toronto, Ontario M9W 6N9

Report Description -	PORT HOPE SOIL SAMPLES
Special Instructions -	RUSH

Approved by:



s.19(1)

Scientist
 Phone - (416)207-6000 ext [redacted] FAX - (416)207-5550
 Email - [redacted]@kinectrics.com

The following samples were submitted for analysis:

Sample #	Sample Name	Sample Location	Sampling Date
1	[redacted] BH01	PORT HOPE	05-Aug-2010

Sample #	Analyte	Result	Units	MDL	Technique	Uncertainty	Test Date
1	Radium-226	<0.24	Bq/g	1	ICPMS		15-Aug-2010
	Thorium-230	<0.2	Bq/g	1	ICPMS		15-Aug-2010
	Thorium-232	0.005	Bq/g	1	ICPMS		11-Aug-2010
	Arsenic	1.68	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Antimony	1.71	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Cobalt	4.1	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Copper	3.68	ppm	0.050	Digestion/ICPMS		10-Aug-2010
	Nickel	12.9	ppm	0.10	Digestion/ICPMS		10-Aug-2010
	Uranium	0.795	ppm	0.01	Digestion/ICPMS		10-Aug-2010
	Lead	13.1	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Barium	413	ppm	0.0500	Digestion/ICPMS		10-Aug-2010
	Beryllium	0.815	ppm	0.50	Digestion/ICPMS		10-Aug-2010
	Boron	9.68	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Cadmium	<0.05	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Mercury	<0.05	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Molybdenum	0.254	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Selenium	<1	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Silver	0.175	ppm	0.05	Digestion/ICPMS		10-Aug-2010
	Vanadium	33.9	ppm	0.0050	Digestion/ICPMS		10-Aug-2010
	Zinc	26.3	ppm	0.10	Digestion/ICPMS		10-Aug-2010

\$0.00 billed to Account Number/PO# - 0020N-015367-004.0020 NO CHARGES.

s.19(1) Analysis performed by:



The Analytical and Environmental Services Laboratory of Kinectrics is certified by the Standards Council of Canada as conforming with ISO 17025. All methods and procedures adhere to strict guidelines and quality control protocols. Quality control documentation and data is available for review at any time. A summary of the methods used in these reports follows, with references to more detailed documentation where appropriate.

All analytical data is subject to uncertainty, and is a function of the sample matrix, method and instrumental variations. As a general guideline, it can be expressed as +/-50% of the result at the detection limit (MDL) and approximately +/-10% of the result at greater than 10 times the MDL. Detection Limits, or MDL's are defined as approximately 3 times the standard deviation (99% confidence level) of a low level standard as per Ontario MOE protocol (1999). They are based on undiluted samples with relatively clean matrices. Where dilutions are required, the reported MDL's will be higher. If detailed calculations are required, please contact us.

All results are based on the as-received sample basis.

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Appendix H

LLRWMO - Laboratory Analytical Results Ra-226

LLRMMO-Laboratory										
Analytical Results-Gamma spectroscopy										
Soil Samples-Sample Set # 2010-84										
Site:	SRCA Sites	Mass g	Count time (sec)	*Ra-226 Bq/g	Activity Uncertainty Bq/g	Uncertainty %	MDA Bq/g	batch start date	Approximate Ingrowth	alpha/beta/gamma scan
20100516	BH01-COMPOSITE	211.3	1800	0.009	NA	NA	0.013	10-Dec-07	1 DAY	
*Ra-226 activity is estimated based on the activity of Bi-214 at 609 kev, assuming equilibrium between the two. Radium-226 was not in equilibrium with Bi-214 at the time samples were analyzed, therefore some increase in activity can be expected over a 3 week period after containers were sealed. Samples were not prepared, therefore may contain moisture, and other materials (eg. rock, vegetation). Activity uncertainty quoted at 1 sigma. MDA=Minimum detectable activity (above sample background)										
ID#	Description	Mass g	Count time (sec)	Ra-226 Bq/g	Activity Uncertainty Bq/g	Uncertainty %	MDA Bq/g	Target Bq/g	Batch Start Date	
20030010 BKD+3		173	1800	0.10	0.008	8.0	0.014	0.139	10-Dec-07	

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Appendix I

Surfaces and Objects Analytical Summary

Surface Contamination Results

Site No	Level/ Floor	Location	Total Surface Radiation Bq/cm ²	Loose Alpha Radiation Bq/cm ²
	Main Level	Side Door - Threshold	ND	
		Side Door - Walls	ND	
		Side Door - Door /Knob	0.07	
		Front Door - Threshold	ND	
		Front Door - Door /Knob	ND	0.008
		Front Door - Bench	0.03	
Exterior		Woodshop - Floor	0.13	0.00009
		Front Door - Threshold	0.13	ND

Total Surface Radiation - direct reading in field

Loose Alpha Radiation - laboratory result for swipes obtained over 300 cm²

ND - non-detectable/indistinguishable from background