Ministry of
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Ontario Geological Survey
Open File Report 5876

Investigation of Soil Gas Radon as a Petroleum Exploration Technique

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ONTARIO GEOLOGICAL SURVEY

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By

J.E. Tilsley and P.R.J. Nicholls

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ABSTRACT

In the fall of 1992 a program of radon soil gas sampling was conducted in 13 test areas centred on the Wallaceburg area, southern Ontario. Ten of the test areas were located to cover areas of current or historic oil or gas production, while 3 of the areas serves as control sites. This work was follow-up to a regional study completed in 1991 which indicated that soil gas radon had the potential to be a useful tool in the exploration for oil and gas fields.

In addition to soil gas samples, soil samples were collected at all field sites for radon emanation potential (apparent radium) studies. This aspect of the work was undertaken to evaluate if soil sampling could be substituted for soil gas sampling.

The wet ground conditions prevailing during the 1992 study resulted in lower soil gas radon concentrations than were recorded during the 1991 study. However, in most cases results indicate a contrast in soil gas radon readings across most of the oil and gas pools. Results obtained in the 1992 survey demonstrate a resasonable correlation (0.85) between radium, apparent and uranium content of the soils. Data from this survey also indicates a poor correlation (0.2) between apparent radium in soils and radon in soil gas; sample-to-sample correlation is poor as well.

Investigation of Soil Gas Radon as a Petroleum Exploration Technique

by J.E. Tilsley[1] and P.R.J. Nicholls[1]

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INTRODUCTION

The Ontario Geological Survey initiated a regional soil radon gas study in September of 1991. Results of this work showed a strong relationship between radon concentrations and oil and gas fields in the Wallaceburg area of Southwestern Ontario (tilsley et al. 1993).

To further investigate these reults a second programme, the 1992 study was designed to determine soil gas radon concentrations in locations in southwestern Ontario selected to represent typical conditions related to known petroleum and natural gas fields. Data was also collected for control or "background" purposes in 3 areas of no known oil or natural gas accumulations.

The follow up 1992 study described herein included soil gas radon measurements in 13 areas (Figure 1) located near the town of Wallaceburg.

Studies were carried out in the following areas: (Figure 1).

1 Control Area 1 (CA1), (Surface: Clay, silt & sand on black shale till)
Sombra Township, Concession VIII, Lots 13, 14, 15, 16

2 Control Area 2 (CA2), (Surface: Black shale till)
Sombra Township, Concession XIV, Lots 26, 27, 28, 29, 30

3 Control Area 3 (CA3), (Faults with no known reserves/production)
Sombra Township, Concession V/VI, Lots 16, 17, 18, 19, 20, 21, 22

4 Chatham Gas Field (CH) (Silurian)

5 Clearville Field (CL) (Cambrian, faulted)

6 Coveny Field (CO) (Silurian incipient reef)

7 Dawn Gas Field (DG) (Silurian, on Dawn Fault)

8 Dover (DO) (Ordovician, oil & gas)

9 Dover New Field Pool 7 - 5- VE (DN) (Ordovician, oil & gas)

10 Florence-Oakdale Field (FL) (Devonian)

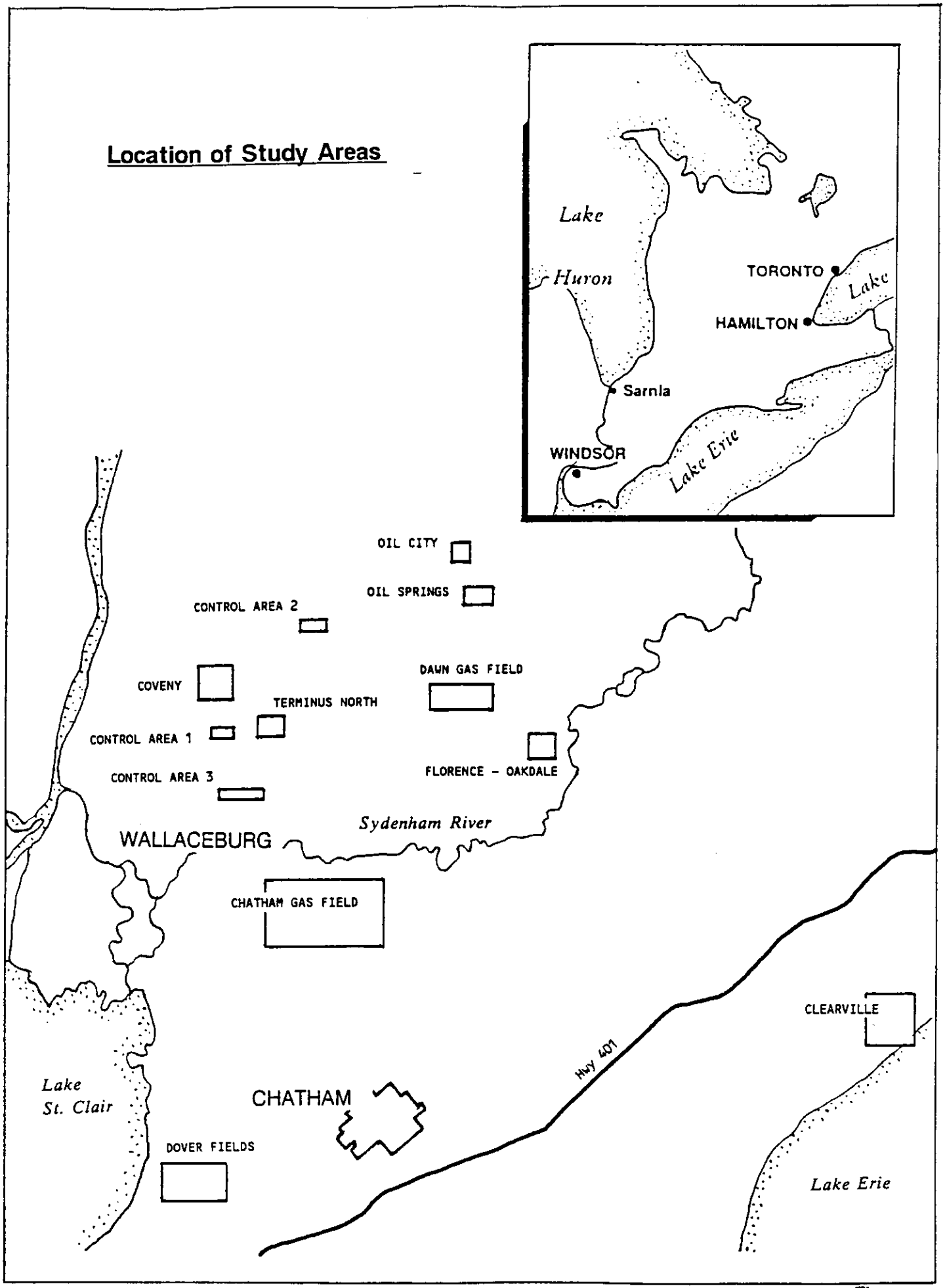

Location of Study Areas
Lake
Huron
TORONTO
Lake
HAMILTON
Sarnia
WINDSOR
Lake Erie
OIL CITY
OIL SPRINGS
CONTROL AREA 2
COVENY
DAWN GAS FIELD
TERMINUS NORTH
CONTROL AREA 1
FLORENCE - OAKDALE
CONTROL AREA 3
Sydenham River
WALLACEBURG
CHATHAM GAS FIELD
CLEARVILLE
Hwy 401
Lake
St. Clair
CHATHAM
DOVER FIELDS
Lake Erie

Figure 1

11 Oil City [Enniskillen 1-16-IV Pool] (OC) (Silurian)

12 Oil Springs (OS) (Anthropogenic influences of oil production)

13 Terminus North (TN) (Silurian incipient reef)

In addition to soil gas studies, soil samples were collected for radon emanation potential studies. This phase of the study was intended to determine if soil sampling and analyses for radon emanation potential could be substituted for radon in soil gas surveying. Soil sampling can be carried out at any time of year when the ground is unfrozen, while soil gas work is best done during dry summer months.

The first soil gas detectors were placed on October 29, 1992, and all radon determinations completed before December 1st. Total sampling time was 26 to 32 days. During the survey heavy rains saturated the soils and some detectors were recovered from standing water. Saturation of the soils results in depressed radon responses. However, there was generally sufficient contrast between background and anomalies to outline oil and gas fields and faults.

Soil samples were tested in the laboratory for radon emanation potential (apparent radium) by sealing weighed samples in radon proof jars with the same sort of detector as used in the soil gas radon studies. The average radon concentration developed in the flasks over a period of 15 to 25 days was used to determine the radon emanation potential of the soil sample (apparent radium).

The radon measuring equipment used for all determinations was supplied by Rad Elec Inc. of Frederick, Maryland, USA. The radon concentration at most sample locations was determined 2 times, producing a database that shows short and long term radon averages.

The study areas were investigated to establish the concentration of radon in soil gas, and soil samples were collected at all the radon gas determination points. Additional soil samples were collected in areas surveyed in 1991 (Tilsley et al. 1993), and samples from vertical profiles were obtained by

augering. The soil samples were tested for radon emanation potential in the laboratory using E-PERM techniques. About 30 radon measuring devices were deployed in each individual study areas, the actual number ranging from 16 to 45. Sampling points were selected to cover the petroleum-bearing structures and adjacent ground.

Soil gas radon concentrations are variable on daily, monthly, and annual bases. The data collected during the surveys are valid for the time period involved, but will have to be interpreted in relation to measured annual averages and seasonal fluctuations.

Soil samples were collected for laboratory determination of Rn Emanation Potential, an indirect measure of radium concentration. Since the radium concentration does not vary seasonally or with changes in soil moisture content, this part of the study was designed to determine technical and financial aspects of soil sampling as an exploration tool.

The program consisted of the following:

Emplacement of a total of 360 E-PERM™ radon detection cells in 13 study areas. This sampling established radon concentration levels in soil gas during the month of November and the early part of December, 1992.

The detectors were read approximately 7 days after placement, and again and at time of retrieval, measurement times were determined by radon concentration at each sample site, and the time available between deployment and retrieval due to winter weather. Deployment times ranged from 24 to 30 days.

In addition, 659 analyses of soil samples were made to determine radon emanation potential. This was done in order to develop a database to relate apparent radium content of the soils to radon concentration in soil gas along coincident profiles across the selected oil and gas fields and within the control areas.

The total number of radon in soil gas determinations at the 360 field sites established during the program was 720. One hundred and sixty-seven soil samples were assayed by neutron activation for uranium, and 62 of these were also tested for radium at the Atomic Energy of Canada Limited facility in Gloucester, Ontario.

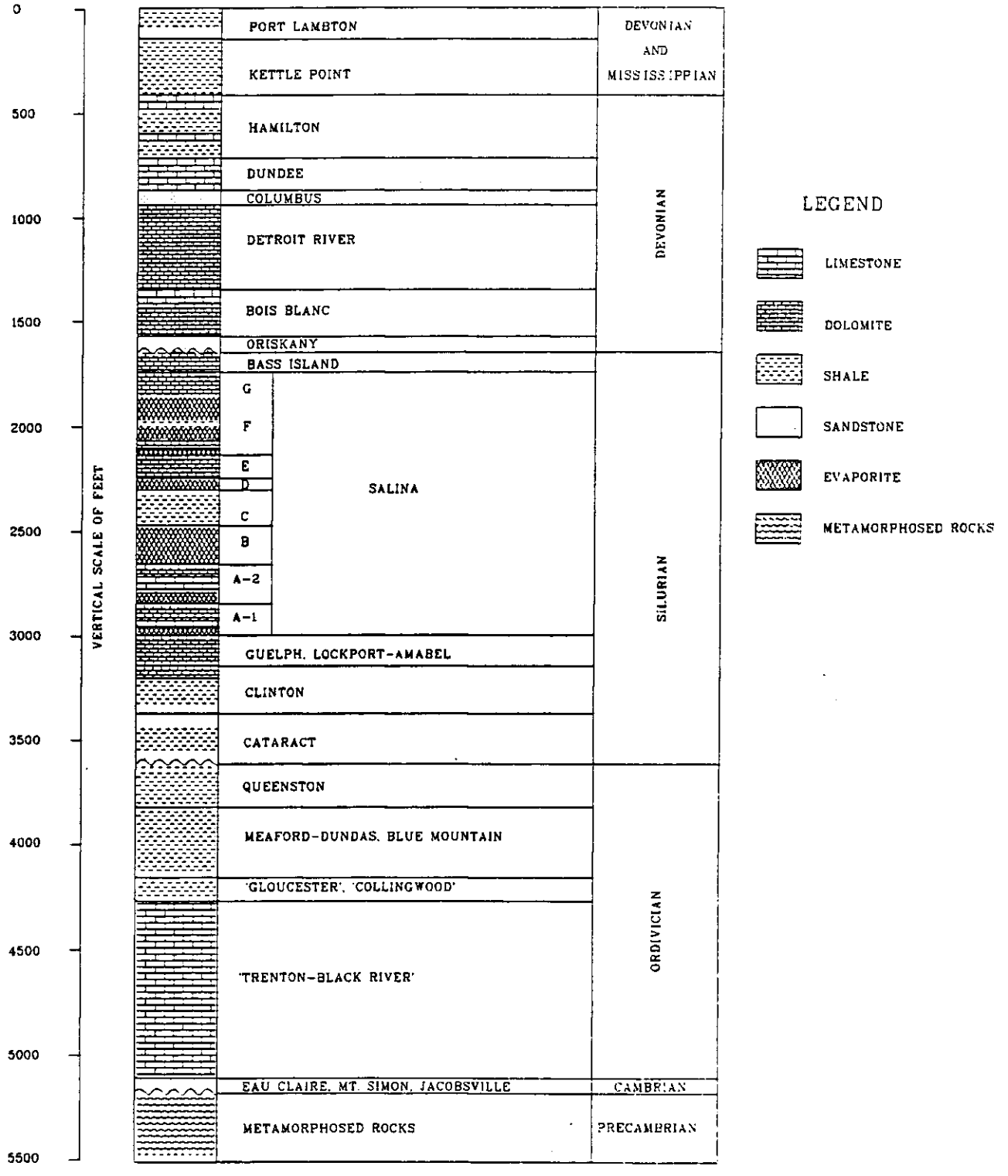
Results of these surveys provide a database for assessing the applicability of the technique to exploration for oil and natural gas, and for designing detailed exploration protocols.

GENERAL GEOLOGICAL SETTING

BEDROCK GEOLOGY

The Wallaceburg study area is underlain by the Upper Devonian Kettle Point Formation black shales, and less extensively, by upper Middle Devonian limestones and dolostones of the Hamilton Group (Ontario Geological Survey 1991). The Kettle Point Formation black shales outcrop on the shore of Lake Huron at Kettle Point where they derive their name from large calcareous concretions known locally as kettles (Russell 1985). The general geological section in southeastern Ontario is shown in Figure 2.

The Kettle Point Formation black shales in the study area lie on the Algonquin Arch between the Michigan Basin and the Appalachian Basin. Thickness is up to about 70 m in this locality. The shales are organic carbon-rich and bituminous. The upper 20 m has a potential oil yield of ~38 L per tonne. Total organic carbon content ranges from nearly zero to slightly more than 15% (Delitala 1984). Natural gamma ray logs of selected stratigraphic holes through the shales suggest that uranium concentration and total organic carbon content correlate closely. Armstrong (1986) reports an average uranium content for the Kettle Point Formation black shales of 34.2 ppm with a maximum of 71 ppm and a minimum of 10 ppm for 45 samples from drill hole OGS-82-1. Delitala (1984) reported an average of 21.3 ppm U for samples from drill holes KP-14 and KP-16. His average uranium concentration for samples from KP-14, KP-16, and KP-24 is 14.6 ppm with a maximum of 36.8 ppm U.



GENERALIZED COLUMNAR SECTION, SOUTHWESTERN ONTARIO
(after Koepke 1964)

Figure 2

The Kettle Point Formation black shales extend into Ohio south of Lake Erie where they are known as the Ohio Shales. Harrell and Kumar (1989) indicate the Ohio Shales carry 10 ppm to 40 ppm U, and show uranium in soils in central and western Ohio to range to >4 ppm, with the highest values confined to areas directly underlain by the Ohio Shale (Harrell et al. in press).

The Paleozoic section in the Wallaceburg area is generally less than 1000m thick and rests on Grenville Province late Proterozoic metamorphic and igneous rocks. The Paleozoic sediments range in age from Ordovician lying, unconformably on the Grenville basement, to Upper Devonian, represented by the Kettle Point Formation.

Oil and natural gas are produced from Silurian and Devonian rocks in the area, from both bioherm reefs and structural traps. East oriented faults cut the bedrock in the study area and form structures that locally trap economic quantities of oil and natural gas. A strong association between elevated concentrations of radon in soil gas and the limits of known oil and natural gas occurrences is indicated by the data.

The Clearville area (Figure 1) has similar bedrock geology. Kettle Point Formation shales subcrop beneath thick overburden. The hydrocarbon producing horizon is Cambrian age Trempleau Formation which is intersected at a depth of ~1160 m.

SURFICIAL GEOLOGY

As was done in the soil gas radon survey completed in 1991 (Tilsey et al. 1993) the test areas were divided into "environments" which are subdivisions of the areas based on differing surficial and bedrock conditions. Within an area each environment has a different composite stratigraphy. For example, in an area each of the following would constitute a separate environment: 1) till over limestone; 2) sand over till over limestone; and 3) till over shale.

The relief in the Wallaceburg area is low. Overburden thickness ranges from about 15 m to over 50 m. Over the Dawn Township oil fields measured overburden thicknesses are in the order of 20 m.

Clayey tills that are derived, in part, from the underlying black shales of the Kettle Point Formation extend through the survey area. This is Environment 2 of Tilsey et al (1993). The clay tills are overlain by discontinuous to extensive patches of glacio-lacustrine silts and sands of Environment 1 of Tilsey et al. (1993).

The surficial materials are similar to those in the Windsor area, clay-silt tills overlain by varying thicknesses of glaciolacustrine clays and silts. However, Kettle Point Formation black shale make up more than 5% of the clay-silt till (Fitzgerald 1979). If the average uranium content of the shale clasts is 20 ppm, this would imply 1 ppm U in the soils. Grasty (personal communication, 1992) calculates ~800 pCi/L of radon per part per million U in soil with 20% porosity. The observed mean radon concentration was ~260 pCi/L in the black shale till, with local average values for the entire sampling period reaching ~1000 pCi/L.

Superimposed on both Environment 1 and Environment 2 is the influence of underlying oil and natural gas deposits. There is no obvious visual evidence of this influence, although there may be remote sensing indications especially during the growing season. There is some suggestion that corn grows more vigorously in areas where "methane" levels in the soil are enhanced.

Soil gas radon concentrations in these areas are clearly elevated. The limits of Environment 3 are arbitrarily set coincident with the surface trace of the known limits of oil and natural gas fields.

Soils throughout Environment 1 have developed from glaciolacustrine silts and clays. Organic layer ranges from 2 cm to 5 cm and averages about 3.5 cm. The upper portion of the soil is usually light to medium brown lying on a mottled gray and brown clay that begins about 20 cm below surface.

Occasionally the soils are light to medium gray and, rarely, almost black. Below 30 cm the soil grades into unweathered silt-clay that is light to medium brown, sometimes mottled.

The soils developed on the black shale till are usually gray to dark gray or black. The humic layer is 3 cm to 5 cm thick followed by 20 cm to 30 cm of developed soil which grades into relatively unweathered till at ~40 cm. Occasionally black shale clasts can be identified in the lower part of the soil section. In several locations a gray-brown stony till is exposed below 35 cm.

Soil profiles in Environment 3 tend to show brown to tan with some yellow-brown colouration extending from the bottom of the 2 cm to 5 cm humic layer to about 40 cm below surface. The soils are sometimes dark brown, particularly where black shale clasts, in some stage of decomposition, can be identified. The tendency toward light brown to yellow brown colour of the deeper part of many of the soil profiles studied in areas above oil and natural gas fields may be indicative of influences relating to presence of volatile hydrocarbons. The light brown to yellowish mottling would suggest oxidation of reduced iron. If hydrocarbons were present in quantity in the soils, it would be reasonable to expect more reducing conditions as opposed to an enhanced oxidizing environment. The role of soil microorganisms that are encouraged by volatile hydrocarbons, perhaps a variety of ferrobacteria, might be considered.

The Clearville study area shows thick clay till in the northern and western part. In the eastern part of the area medium to fine sands are exposed at surface. Some of the streams are incised into the till plain 10 m to 20 m. Overburden thickness ranges from about 50 m to 85 m.

HYDROGEOLOGY

Topographic relief through the Wallaceburg part of the study area is gentle. Surface drainage is naturally sluggish. Temporary surface flooding is common. Ditching and tile drainage systems are necessary for efficient large-scale cultivation.

The area is drained by the Sydenham and North Sydenham rivers and their tributaries. Flow is generally south in the tributaries of the Sydenham River, then west to the St. Clair River. The North Sydenham River flows generally east to west in the northern part of the study area, then south to Wallaceburg and, eventually, to the St. Clair River.

The natural water table is shallow, usually within several meters of the surface. Groundwater movement is generally slow due to the relatively impermeable black shale tills and low hydraulic head related to the gentle relief. No extensive zones of enhanced groundwater flow were identified.

In the Clearville area drainage is south to Lake Erie. The clay tills are poorly drained as in the Wallaceburg area. In the areas underlain by sands vertical drainage is good and soil development extends to depths of 1 m or more. The sandy areas show more pronounced relief than the part of the field that is underlain by clay tills, with a pleasant rolling aspect between the modestly incised stream valleys.

ANTHROPOGENIC FEATURES

Agriculture is the chief activity in the Wallaceburg part of the study area, farming is extensive and much of the area is ditched and tile drained. Phosphate and potash fertilizers are widely used but their influences on survey results were minimized by selection of sampling points in non-cultivated locations.

The Wallaceburg area has a history of oil and natural gas production from Silurian and Devonian age sediments. Both production and storage fields are identified. Collection and transmission pipelines extend through the much of the northern half of the area. Slight thickening of the upper soil profile due to collection of wind-blown soil was observed in some headlands and grassed verges of roadways.

The towns of Wallaceburg and Dresden lie within the study area, and presented no technical or logistics problems.

Farming is less intensive in the Clearville area with cleared land accounting for about 60% to 70% of the land surface. The rest of the area is covered by native forest or uncultivated farm land returning to bush.

METHODOLOGY

It must be understood that there may be pronounced variability in radon concentration in soil gas from one sample point to another, even within well defined geological environments. These variations reflect geological factors, weather changes, anthropogenic disturbances, et cetera. Proper interpretation of results requires careful observation and data recording at each site. Detector deployment was undertaken by personnel with training and experience in soil gas radon surveying. Since glacial deposits cover most of the areas to be investigated, each area was inspected at the time of detector deployment to ensure they were assigned to the correct environment. Most of the areas selected for detailed study in this programme have been covered during the regional surveys done in 1991 (Tilsey et al. 1993). The 1992 work was done using the same environment definition. In cases where the selected study area lies outside the 1991 surveys, e.g. Clearville, surficial geology observations were made and designations compatible with the previous year's work were assigned. Other surficial and bedrock geological features were recorded, including composition of tills and related glacial sediments, nature of soils developed thereon, jointing in till and bedrock, et cetera, such as might influence radium and radon concentrations.

Inspection was made of all sample sites to avoid placing detectors where radon concentrations might be influenced by human activity such as buried service lines, field tile drainage, use of phosphate fertilizer, and so on.

The purposes of this study were served by sample spacing of 100 m or less, on profile lines laid out to cross the structures being studied.

Full grid patterns were not used in this investigation, since it was considered important that

information from the selected study areas be gathered and interpreted before a detailed investigation is planned. The profile approach gave information on which oil and gas fields yield responses that may be useful in exploration, and will indicate maximum sample spacing for future regional and detailed studies.

In the case of the study of anthropogenic effects of petroleum production in the Oil Springs area, special attention was paid to historical data and an attempt made to separate natural accumulation of radium in the surface materials from radium introduced by development and exploitation of the oil and gas resources.

The Rad Elec Inc. E-perm™ radon gas measuring system was chosen as the most applicable to the requirements of the survey. The radon detector is a charged teflon disk that carries a quasi-permanent electric charge fitted in a 50 mL ion chamber. Any radon disintegration event within the chamber produces charged particles (ions). The static charge on the disk attracts these ions which, one by one, reduce the charge on the disk. The surface voltage drop over a known time is a measure of time-integrated ionization during the period of exposure (Appendix 1). The system includes the charged disks, electrically conducting plastic housing for the disk (electret), and a voltage reader that is used to measure the voltage on the electret before and after exposure. The voltage drop is recorded and converted by calculation to average radon concentration during the period of exposure. The principle and application of this technology has been described by Kotrappa et al. (1988, 1989). Lyon et al. (1990) published very interesting results of an EPA comparison of CR-39 alpha track detector and E-Perm radon measurements under controlled conditions.

Thoron is often present in soil gas at some level of concentration. Results of work done in the area during the 1991 programme established that the thoron contribution is not significant. Therefore, it does not appear necessary to measure thoron concentration, nor to apply any sort of correction during calculation of radon concentration.

Gamma radiation measurements made during the 1991 programme were used to obtain the contribution from this source to the apparent radon concentration. There was not enough time during the 1992 program to establish a reliable gamma radiation contribution using the E-PERM technique employed previously. The average gamma dose characteristic of the area established in 1991 can be applied without introducing significant bias, since the correction for gamma contribution, particularly at the radon concentrations known in the soils of the region, is not large in any case.

SOIL GAS RADON CONCENTRATION DETERMINATIONS

The detectors were placed 15 cm to 30 cm below the surface of the soil in small-diameter excavations. The ion chamber was protected from flooding by an inverted 750 mL container and a radon-transparent waterproof envelope. The excavation was sealed using the soil removed from the hole and placed on a plastic sheet resting on the detector container. The plastic facilitates recovery of the detectors for short-term reading and final recovery when frozen ground may present some problems.

In agricultural areas, the sampling points were chosen, as much as was possible, in undisturbed locations along township, county and provincial highway rights of way.

Detectors were read about 7 to 10 days after placement, and re-set for a longer period that depended on the local soil gas radon concentration. Second reading of the detectors was done 24 to 30 days after initial deployment.

Radon concentration determinations are based on detecting and counting random disintegration events, which is a statistical process. Radon sampling in soil is complicated by a wide range of influences ranging from geology, through weather, to anthropogenic disturbances. While it is the purpose of the surveys to measure concentrations that are responding to geological influences, transient fluctuations due to changing weather conditions and other daily, monthly and seasonal factors can depress or accentuate short-term concentrations.

Therefore, when precise determination of radon content at any location is required, long-term monitoring is necessary. Ideally, radon determinations should be done throughout an entire year to permit measurement of long-term average concentrations. However, results of the 1991 programme indicate that, except during flooding of the sampling locations, there is strong radon contrast and exposure times as short as 7 days are adequate to define an anomaly. But, the longer the period of continuous radon measurement, the more secure the concentration estimator will be.

The data collected in the 1992 program is properly representative of radon concentrations during the sampling period, but must be accepted as subject to adjustment for natural variations such as noted above (Appendix II.)

DEVELOPMENT OF A SOIL SAMPLING APPROACH

While the determination of radon concentration in soil gas approach has certain advantages in terms of obtaining useful information quickly during the summer field season, water saturated soils reduce the utility of the technique. The general advisability of extended deployment times (usually >30 days) complicated by the requirement that detector packages must be recovered before the ground becomes frozen in late November or early December, limits the starting time for surveys. Furthermore, variation in the radon content of soils from one sampling period to another may be caused by changes in moisture content, atmospheric pressure, speed and direction of winds, et cetera.

Results of the 1991 and this study indicate that the radon content at any sampling site is primarily a function of the radium content of the soil within less than five meters of the detector. The range of significant influence of any radium concentration, in the vast majority of cases, is less than 2 m.

The radium content of the soil is not variable on a seasonal basis.

One hundred and fifty-seven soil samples randomly selected from the study areas were assayed

using neutron activation techniques for uranium, and 63 of these were also assayed for total radium by gamma ray spectometry techniques at the Port Hope facility of Atomic Energy of Canada.

Uranium, radium, and apparent radium (radon emanation potential) data are given in Appendix III.

DISCUSSION OF RESULTS

SOIL GAS RADON CONCENTRATIONS

Wet and saturated to flooded soils during the 1992 survey presented physical and technical problems in many areas included in the study. The chief difficulty is caused by the reduction in effective sample size as the soil becomes saturated. Based on data given by Thompkins (1982) a flooded soil gives a detector an effective sample volume equal to a cylinder having the diameter of the open end of the detector housing and a height of less than 3 cm. In dry soil conditions, the same detector would be influenced by radium present within a complex volume that may be approximated by a truncated cone with a height of as much as 250 cm. The effective sample weight in dry soil is likely to be in the order of 1000 kg or more, as compared to 1 kg or less if the soil is flooded.

Water content of the soils is clearly the most significant variable in soil gas radon surveying. Other influences, such as changing atmospheric pressure, wind velocity and direction, et cetera, will contribute to variation in results from time to time, but not to the extent that soil moisture does. In the areas surveyed in 1992, the contrast between background and anomalous conditions is reasonably strong, and barring flooding of sampling sites, most anomalies will be evident, even under poor sampling conditions, if a sufficient number of measurements are made.

Ideal conditions for this sort of survey are likely only during the summer months when moisture content of the soils is relatively low. Experience with the initial short-term measurements made to determine the discharge rate of electrets, exposure times as short as 7 to 10 days are adequate for

exploration purposes. Health physics or legal purpose surveys will require longer exposures, but mainly for security of scientific data and to provide databases that are legally defendable.

APPARENT RADIUM SURVEYING

The short half-life of radon gas restricts the distance it can migrate from its point of origin as the result of radiogenic decay of its parent radium. In soils, it is unlikely that radon can migrate more than 2 or 3 m, with a maximum of 5 m under ideal conditions of porous soil and significant advection.

Therefore, soil gas radon must be generated from radium in the soil within a few meters of the detector. Since this is the case, measurement of radium would seem a valid approach, particularly since the radium concentration does not vary from season to season or from year to year.

Radium concentration can be estimated from gamma ray spectrometry measurements made on known quantities of soil. This is standard procedure in common use for over 30 years.

Radon emanation potential measurements, or apparent radium measurements will also give a measure of the radium content of the soil. This is an indirect measurement which relies on the generation of radon from a soil sample in a sealed confined space (flask of known volume). Since the quantity of radon emitted from a soil is less than the total radon generated by radioactive decay of the contained radium, the measurement can be taken to represent "apparent radium" only. The amount of radon actually emitted by soils is variable depending on the mineralogy and the location of the contained radium within the soil-forming minerals. Usually the emanated radon is 15% to 30% of the radon actually generated.

If the soils are consistent in nature from one part of a survey area to another, that is, if the emanation potential is more or less constant, apparent radon values can be used to estimate the actual radium, or used "raw".

The advantage of apparent radium or radium surveys is that soil samples can be taken at any time the ground is unfrozen.

The disadvantage shown by the work done as part of this study is that the difference between local background and "anomalies", in the best case, is less than about 3 times (Figure 3). This subtle relief makes data interpretation more problematic than if anomaly relief is more pronounced.

The majority of soil samples collected for radon emanation potential determinations were taken from the bottom of excavations made for placing radon in soil gas detector packages. This was usually about 40 cm. Results of radon emanation potential measurements on samples from vertical soil sampling profiles indicates there is an enrichment of radium with depth, perhaps peaking at 60 cm to 100 cm below surface. The observed increase in apparent radium is about 30% to 40% in most cases.

Sixty-three randomly selected soil samples were submitted to Atomic Energy Canada for radium analyses by gamma ray spectrometry, and a total of 157 soil sample were assayed by neutron activation for uranium content. Correlation of results of apparent radium with gamma ray spectrometry radium values, and with uranium assays, is quite good (Figures 4, 5, 6, 7, 8 and 9). This confirms that the apparent radium data are reliable and can be related to the total radium and total uranium results.

The appropriate depth for soil sampling for radium has not been established. Results from vertical profiles suggests that surface sampling will give lower values than samples taken at 0.6 m to 1.0 m below surface. The position of the "average" water table seems to be an important factor in the concentration of radium in the soil column. A series of 4 m to 5 m soil cores may be warranted to provide samples for detailed investigation of radium distribution. Certainly soil gas radon must originate from radium relatively close to the detector, but data from this study do not permit reliable correlation between radium and radon concentrations.

CORRELATION OF SOIL GAS AND APPARENT RADIUM RESULTS

Correlation of soil gas radon concentrations with apparent radium values is generally poor (Figure 3). The results from areas with currently well drained, although heavy clay soils, e.g. Coveny, show better correlations than either areas with saturated soils or areas of well drained, well developed soils, e.g. Clearville.

Both uranium and radium will tend to concentrate in the soil profile at the "average" water table. Radium is mobile under reducing conditions. Uranium minerals are relatively stable under reducing conditions, while notably mobile under oxidizing conditions. Uranium can be expected to concentrate just below the water table, while radium, being relatively immobile under oxidizing conditions, can be expected to concentrate in the oxidized material just above the water table.

Soil radon gas measurements reflect the radium content of the soil within the effective volume of the sample. In cases where the soils are relatively well drained and well developed, the water table will likely be deeper than it is in most of the areas studied. Radium determinations made on samples taken at the depth of soil gas radon detector deployment will give lower values than can be expected at the water table. If the water table is within about 3 m of the detector package, the influence of radium concentration is likely to be measurable, and the amplitude of anomalies will be greater than could be expected from the radium concentration measured at the detector.

These conditions would explain the high radon in soil gas values from an area such as the Chatham Gas Field, where the average radon in soil gas during the survey period was 292 pCi/L and the apparent radium was 288.8 pCi/kg (Figure 3). Average radon in soil gas values for the Dawn Gas Field study area were 295.5 pCi/L while the apparent radium average was 924.2 pCi/kg. The Dawn Gas Field has a heavy clay soil that is poorly drained, even after tiling of fields and construction of an extensive regional system of drains, which suggests a high (almost grass roots) watertable. Consideration of the water table position must recognize that agricultural drainage systems in most of the area are less than

100 years old. It is the historic, post glacial, pre-settlement water table that must be established, since this will be the controlling influence on metal deposition.

In all cases, there is a general radium background that relates to the nature of the soils developed on glacial deposits that overlie the oil and gas fields under consideration. Radium related to oil and gas accumulations must be super-imposed on the regional background. If the regional radium background is high, the contrast produced by introduced radium will be less obvious than in an area where the radium background is low. This will add to the problems of data interpretation, particularly if the superimposed radium were, say 100 pCi/kg, in an area where the natural background were 600 pCi/kg. The same introduced radium in an area where the natural radium background is 200 pCi/kg would be much more evident.

Figure 3
All Areas: Comparison of Means for
1992 Survey Results

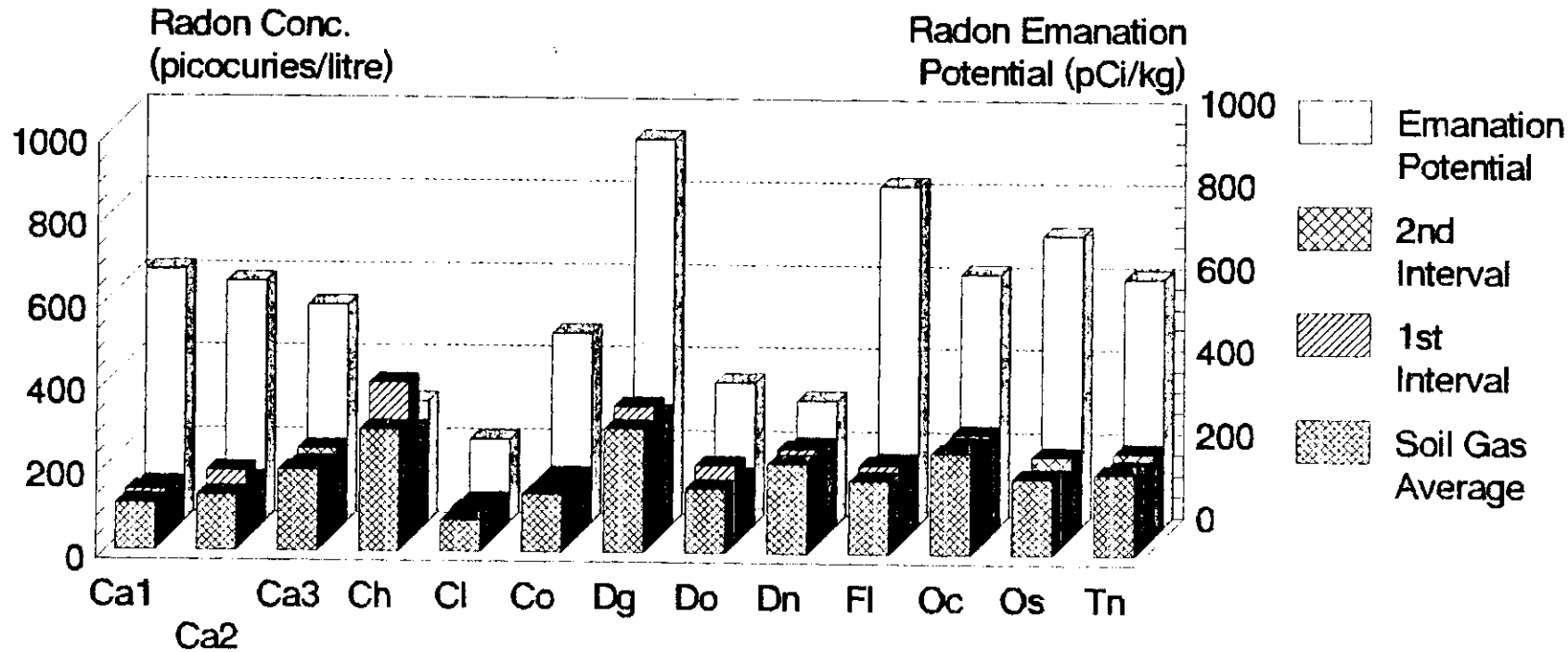


Figure 4

All Areas: Comparison Between Radium and Radon Emanation Potential Results

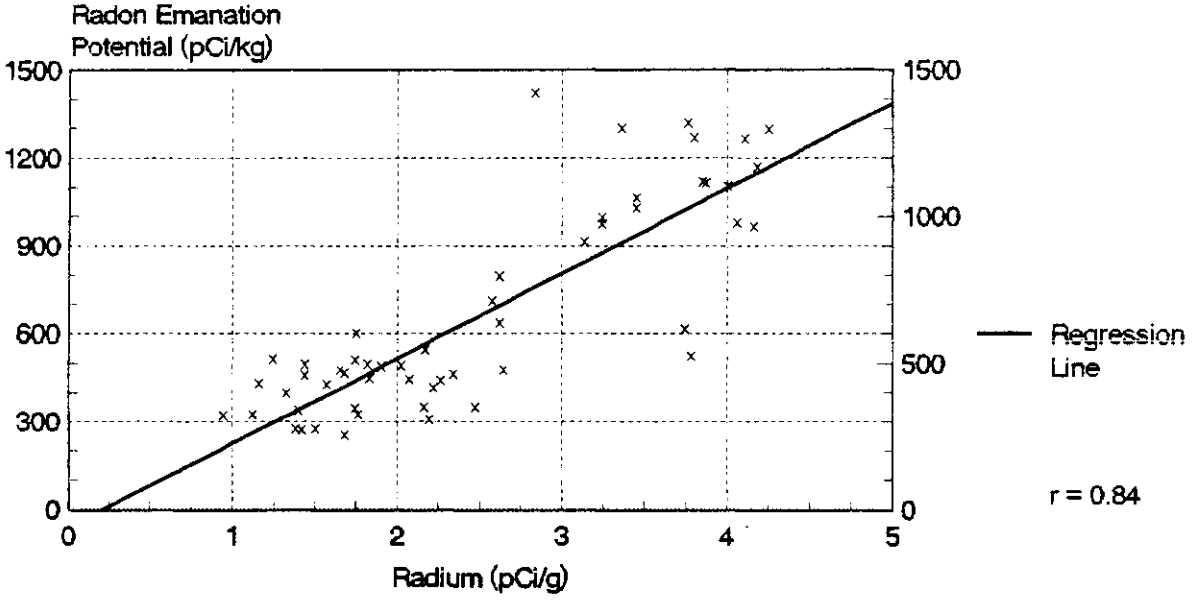


Figure 5

All Areas: Comparison between Uranium and Radon Emanation Potential Results

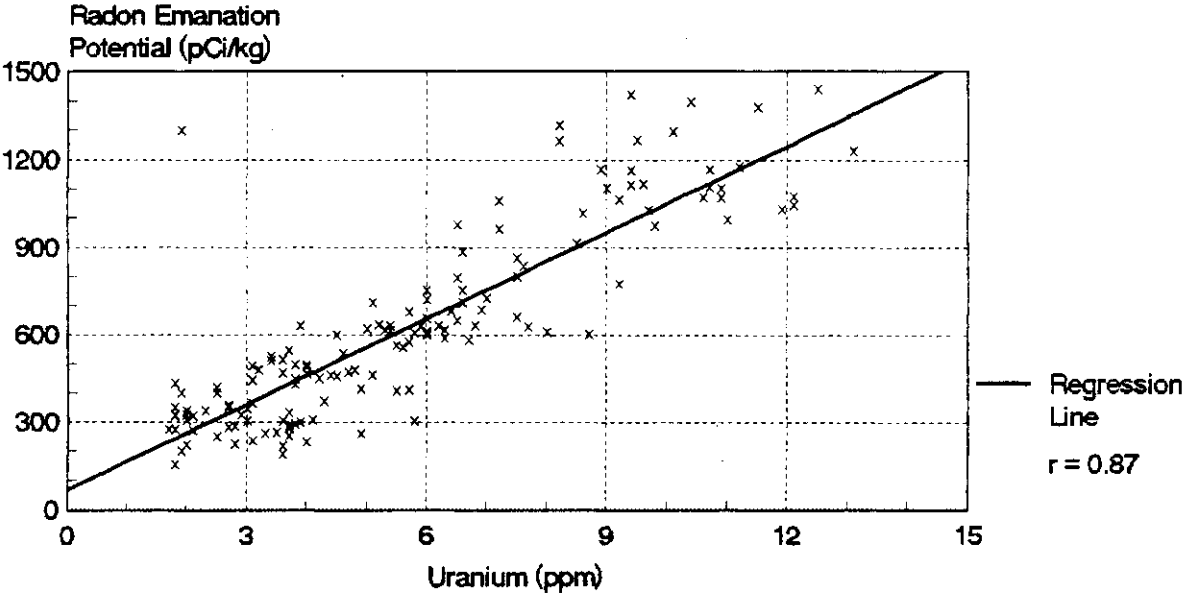


Figure 6

All Areas: Comparison between Uranium and Radium Results

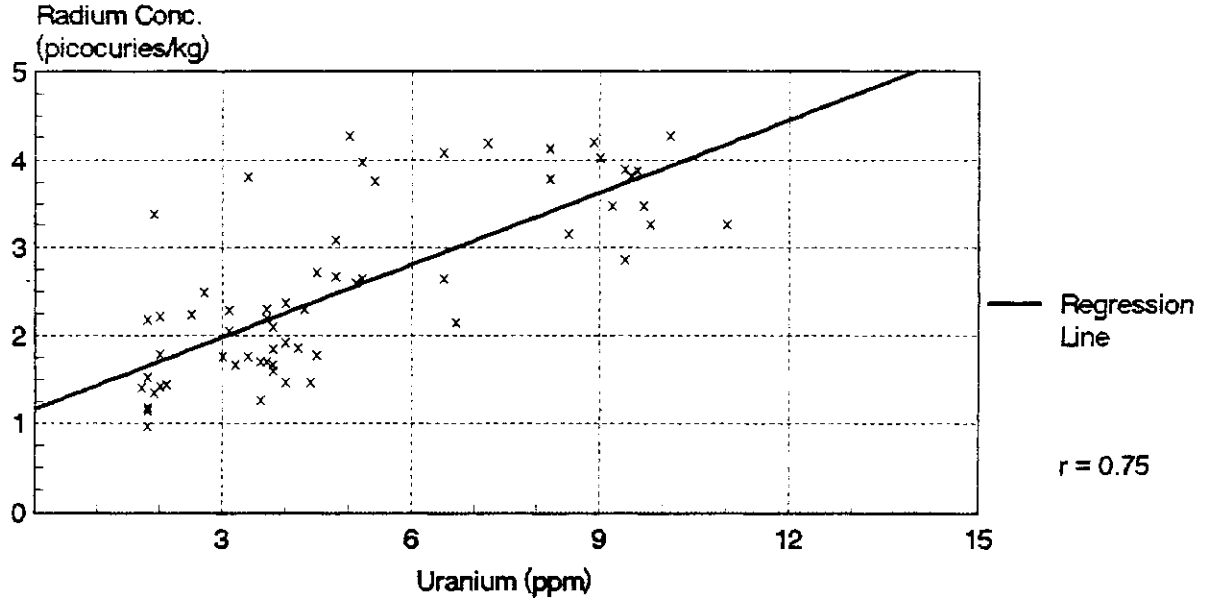


Figure 7

All Areas: Soil Gas Radon versus Radon Emanation Potential Results

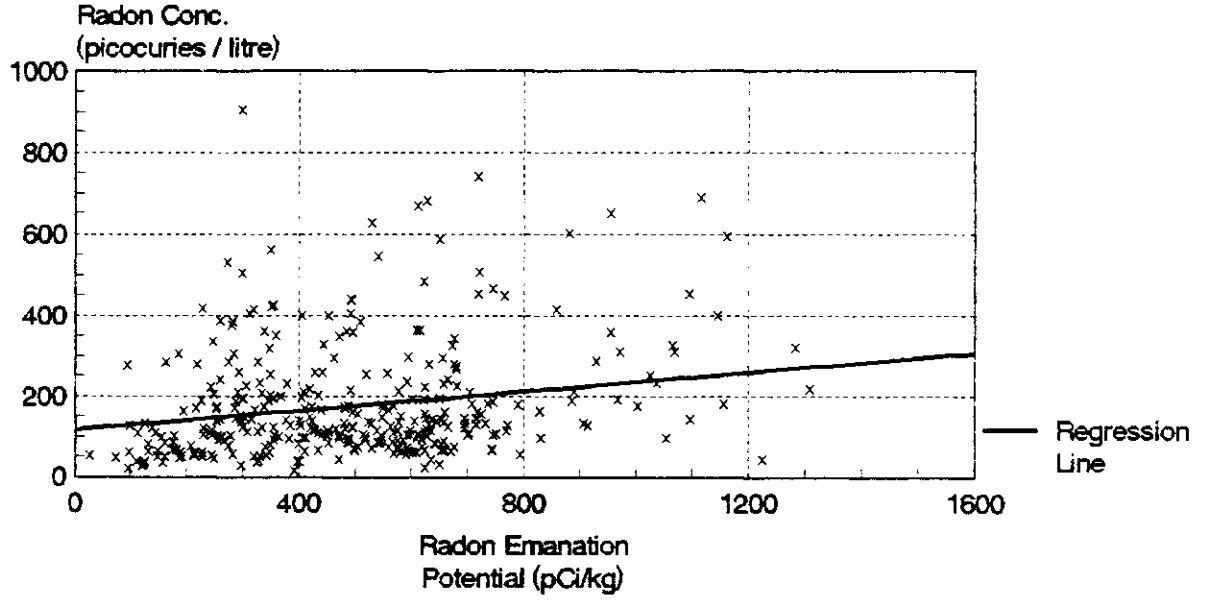


Figure 8
All Areas: Comparison of Means Soil Gas
Radon Results: 1st versus 2nd Interval

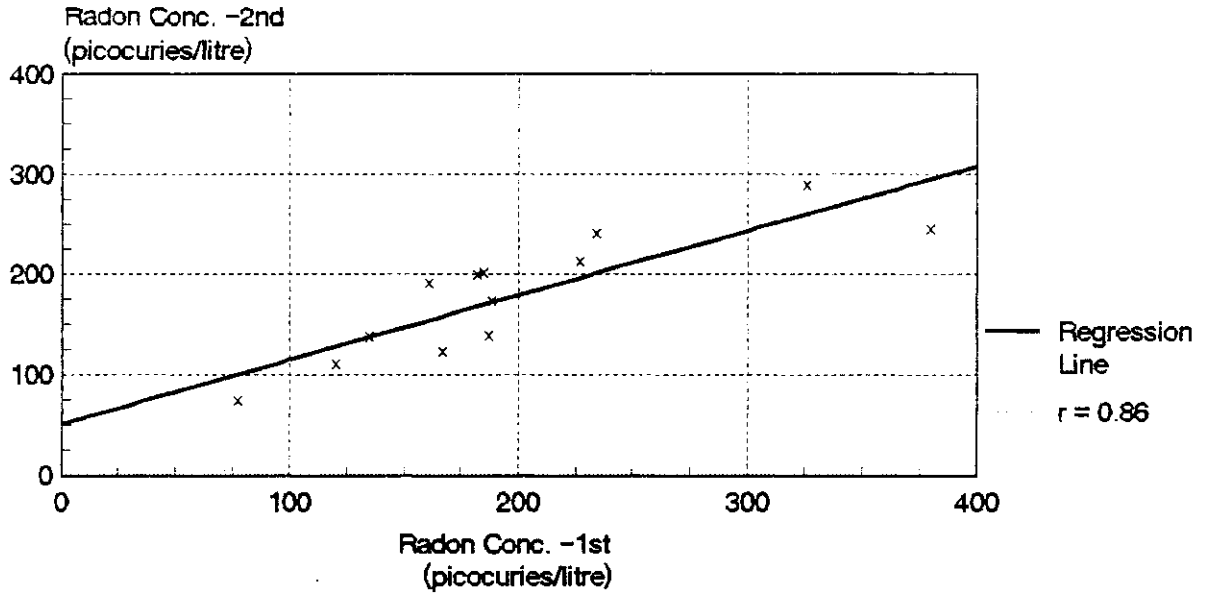
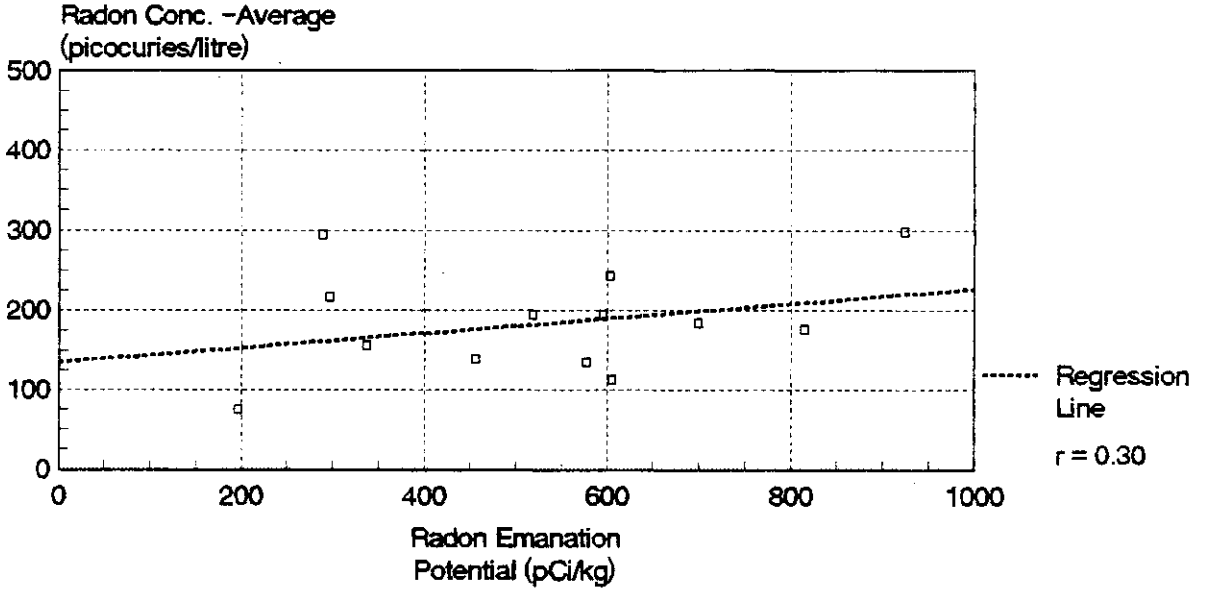


Figure 9
All Areas: Comparison of Means Soil
Gas versus Emanation Potential Results



REVIEW OF STUDY AREAS

In the course of this project 10 petroleum producing areas, and 3 control areas including one to investigate background radon/radium conditions related to known faulting, but with no known associated oil or gas, were studied.

Data collected in each individual study have been tabulated and are presented on sampling plans along with statistical treatment of the data for the particular area.

(CONTROL AREA 1, Surface: Clay, silt & sand on black shale till)
Sombra Township, Concession VIII, Lots 13, 14, 15, 16
Figures CA1-1, CA1-2, CA1-3, CA1-4, CA1-5, CA1-6.

Location	U.T.M. 4725000N, 388000E 17T LT Sombra Township
Surficial Geology	Clay and silt veneer overlying black shale till
Drift Thickness	31m to 33.5m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Strata	N/A
Depth Below Surface	N/A
Type of Reservoir	None known

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
110.0	274.1	36.4	53.5	604.7	829	354	130.0

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
119.9	295.7	48.7	56.8	107.7	294.6	32.7	62.0

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.39	0.42	0.15	0.07	0.29	0.13	0.24	0.10

Background radon/radium concentrations were established with reference to surficial deposits in each study area. Data gathered during the 1991 regional surveying programme (Tilsey et al. 1993) give

a reasonable indication of the responses that can be expected from both the clay-silt-sand cover on black shale till, and on the black shale till itself. However, this investigation gave more detailed information on radon/radium variation within a more restricted area. In both cases there are no known hydrocarbon concentrations within the limits of the study area. In each area 30 soil gas sampling points were established spaced at about 50 m, and 30 soil samples were collected from the soil gas sites for laboratory analysis for apparent radium.

The mean for the radon gas concentration is ~40% lower than the 1991 Wallaceburg Environment 1 (110.0 pCi/L as compared to 180.4 pCi/L (Tilsey et al. 1993).

The area is poorly drained, with 27 of the 30 soil gas sample locations being saturated in November and December 1992. Results show little contrast from one site to another.

Figure CA1-1
Control Area 1: Comparison between Soil Gas and Emanation Potential Results

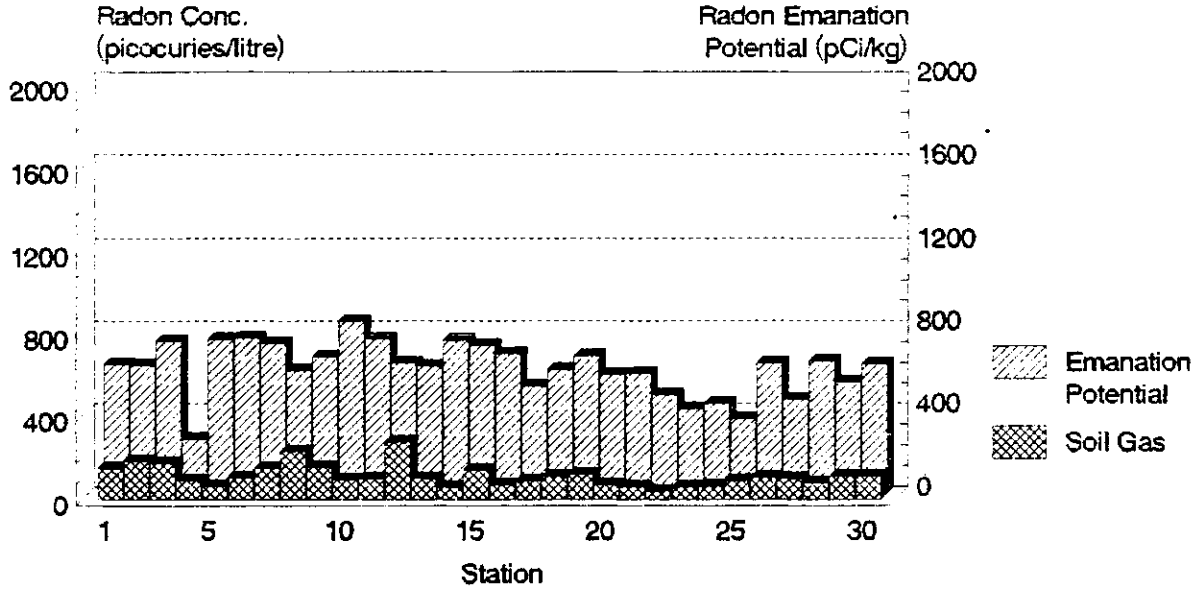
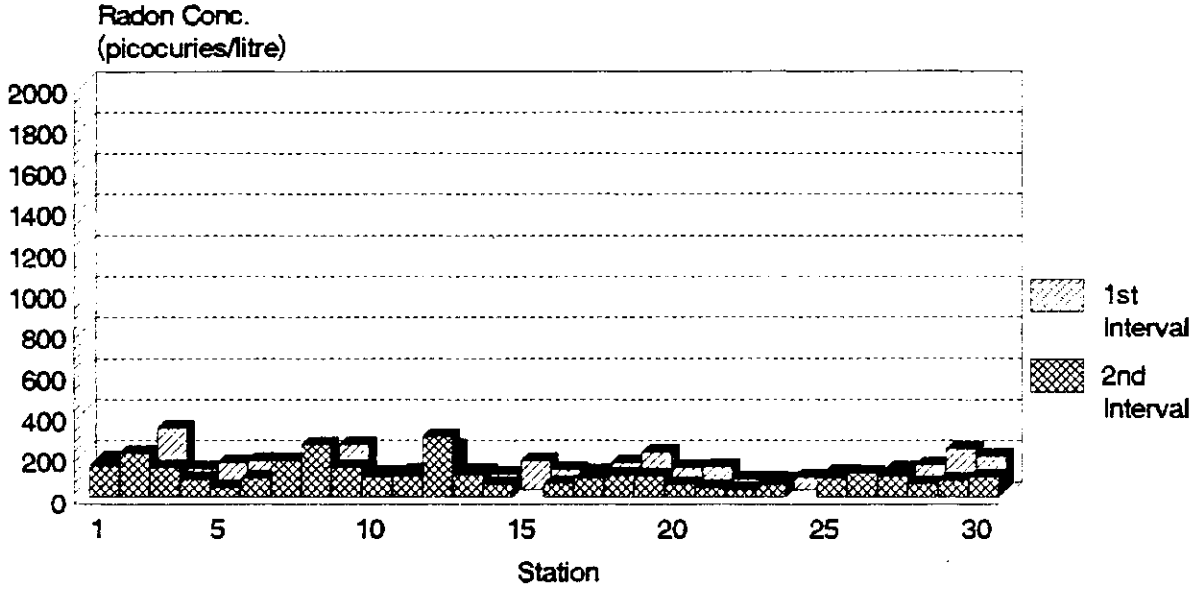
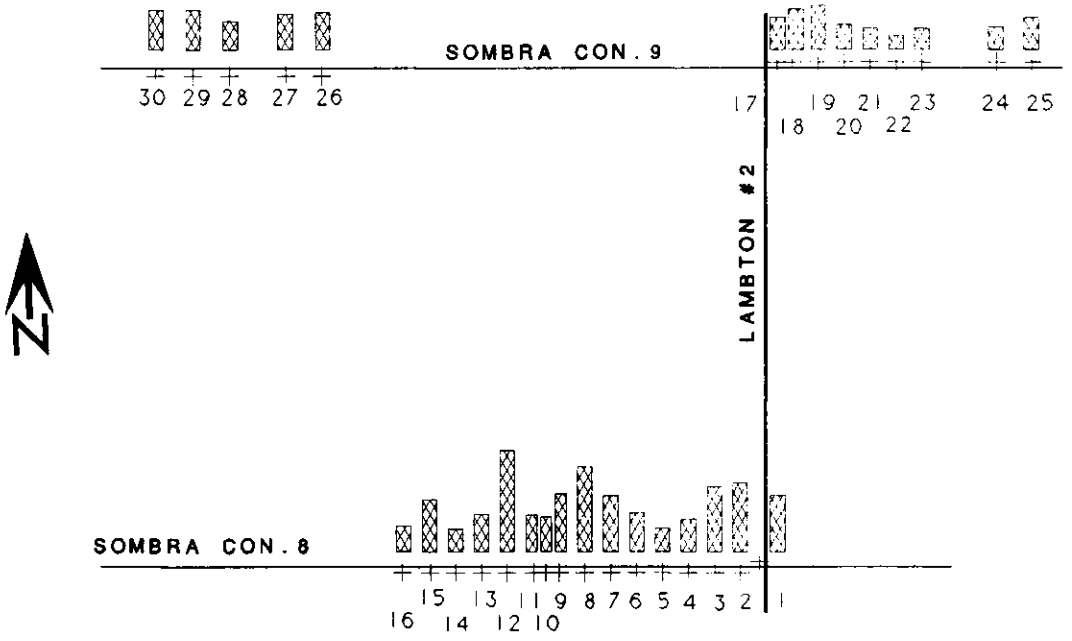


Figure CA1-2
Control Area 1: Soil Radon Gas Concentrations 1st and 2nd Intervals





LEGEND

+ 22 - *Station Location and Number (all stations prefixed by CA-1)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

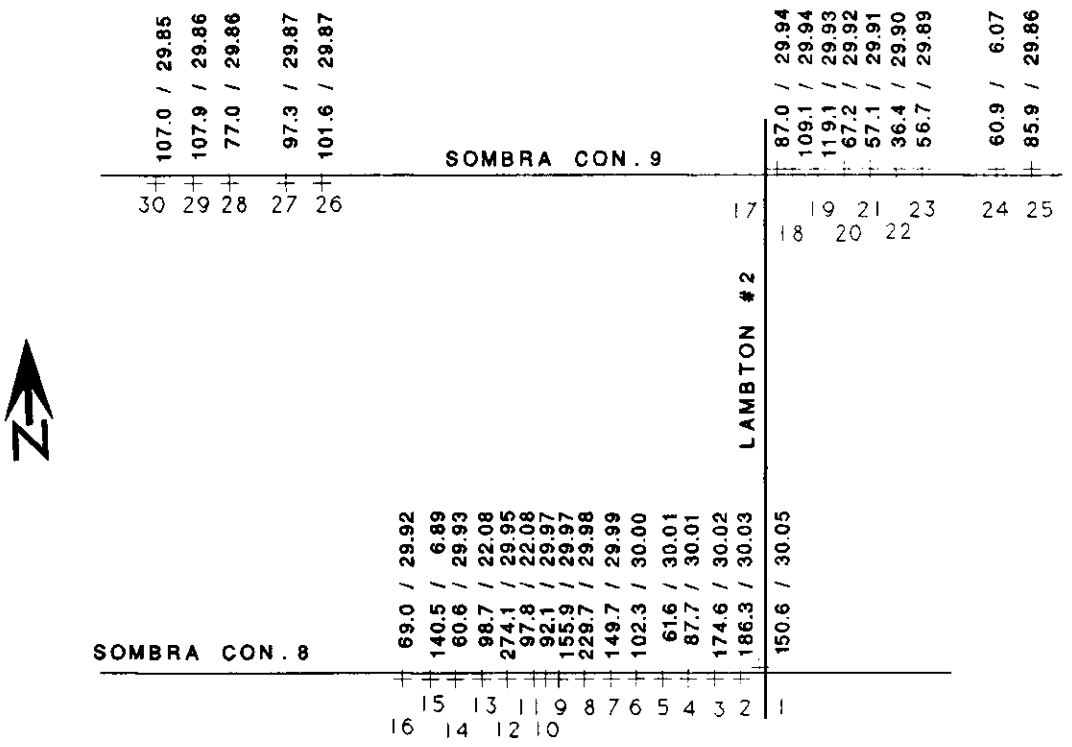
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 1

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CA1-3



LEGEND

+ 22 - *Station Location and Number (all stations prefixed by CA-1)*

99.0/ 22.00 *Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

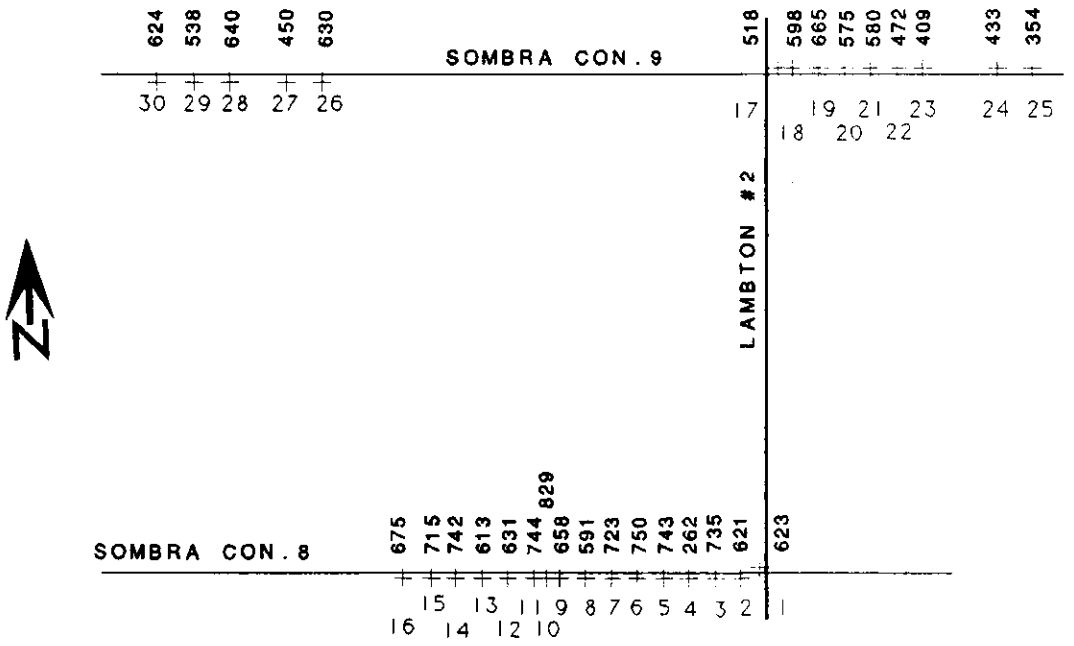
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 1

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CA1-4



LEGEND

+ 22 - *Station Location and Number (all stations prefixed by CA-1)*

545 *Radon Emanation Potential (pCi/kg)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

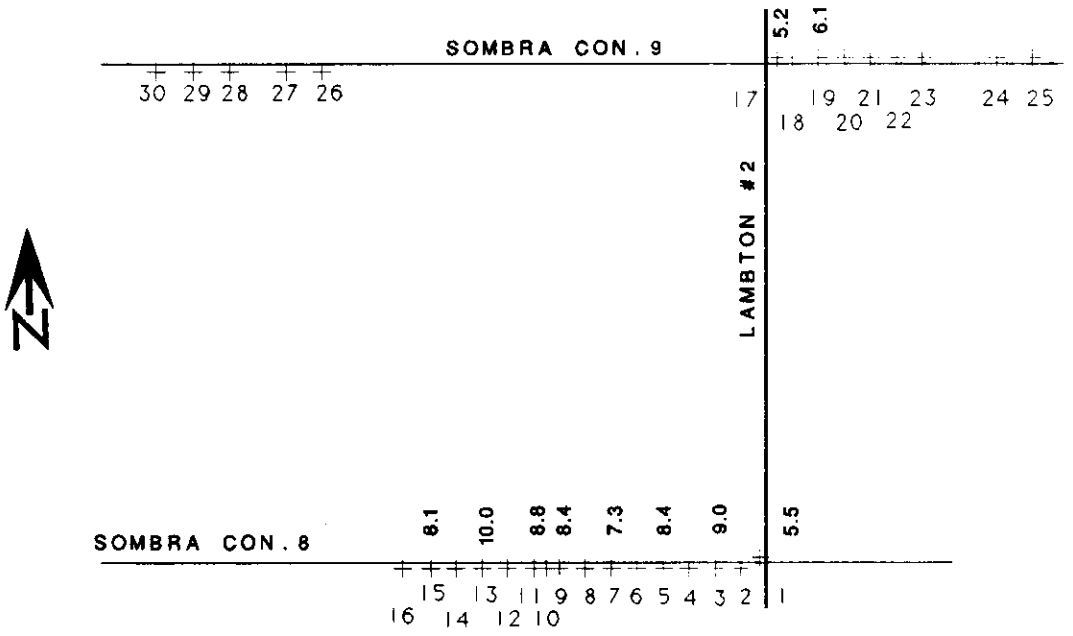
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 1

RADON EMANATION POTENTIAL RESULTS

Figure CA1-5



LEGEND

+ 22 - *Station Location and Number (all stations prefixed by CA-1)*

1.8 *Uranium (ppm)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 1

URANIUM GEOCHEMICAL RESULTS

Figure CA1-6

(CONTROL AREA 2, Surface: Black shale till)
Sombra Township, Concession XIV, Lots 26, 27, 28, 29, 30
Figures CA2-1, CA2-2, CA2-3, CA2-4, CA2-5.

Location	U.T.M. 4730000N, 397000E 17T LT Sombra Township Conc. 13 and 14
Surficial Geology	black shale till
Drift Thickness	25 m to 32 m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Strata	N/A
Depth Below Surface	N/A
Type of Reservoir	None known

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
132.5	336.0	59.5	59.5	576.5	827.0	406.0	103.9

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
166.7	526.6	54.9	92.5	121.0	236.9	44.5	48.6

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.19	0.10	-0.05	-0.04	0.18	0.09	0.07	0.04

Samples were taken on Sombra Concession 13 at the intersection with the Brigden Sideroad and on Concession 14 east of the Brigden Sideroad.

Background radon/radium concentrations were established with reference to surficial deposits in each study area. Data gathered during the 1991 regional surveying programme (Tilsey et al. 1993) give a reasonable indication of the responses that can be expected from both the clay-silt-sand cover on black shale till, and on the black shale till itself. However, the 1992 investigation gave more detailed information on radon/radium variation within a more restricted area. In both cases there is no known concentration of hydrocarbon within the limits of the study area. In each area 30 soil gas sampling points were established spaced at about 50 m, and 30 soil samples were collected from the soil gas sites for laboratory analysis for apparent radium.

The mean for soil radon gas concentration is 50% lower than the 1991 survey average for the Wallaceburg Environment 2; 132.5 pCi/L compared to 261.4 pCi/L in 1991 (Tilsey et al. 1993). Sample locations were in poorly drained heavy clay soil. Twenty-five of the 30 sites were water saturated. The plotted radon concentration profile does not show notable relief. The highest value (336 pCi/L) was from a well drained sample location (Figures CA2-2 and CA2-5).

Figure CA2-1
Control Area 2: Comparison between Soil Gas and Emanation Potential Results

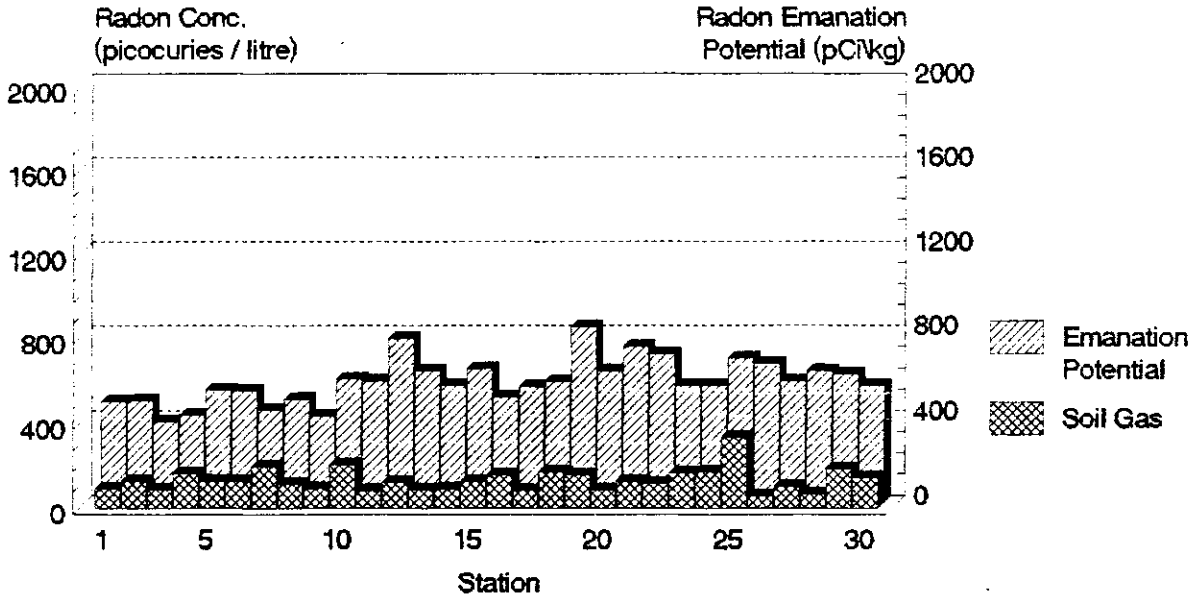
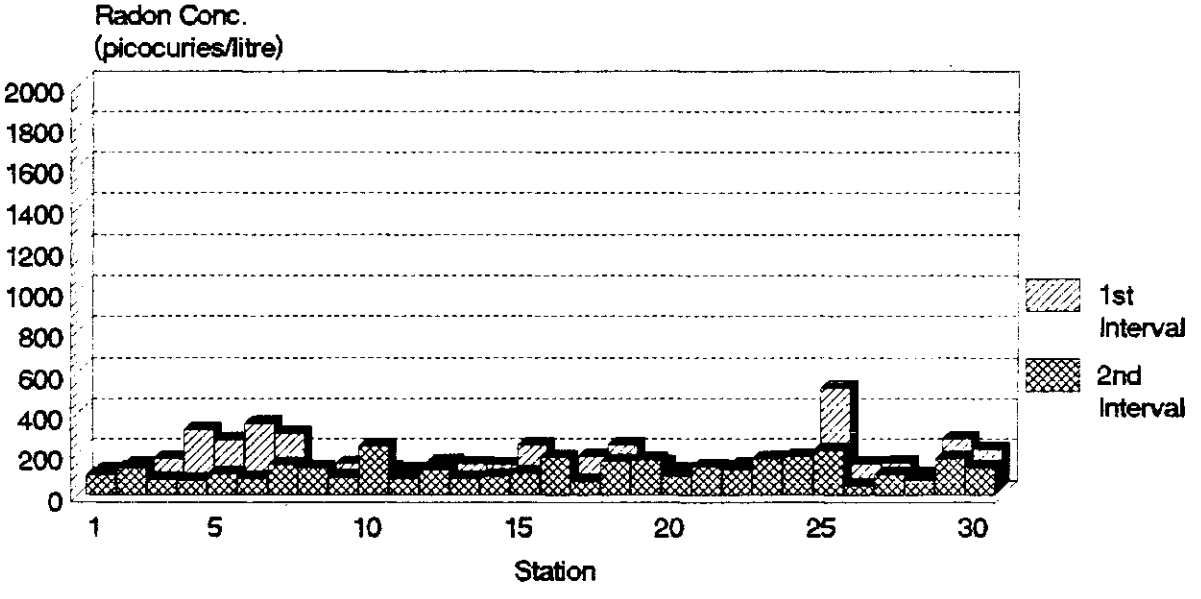
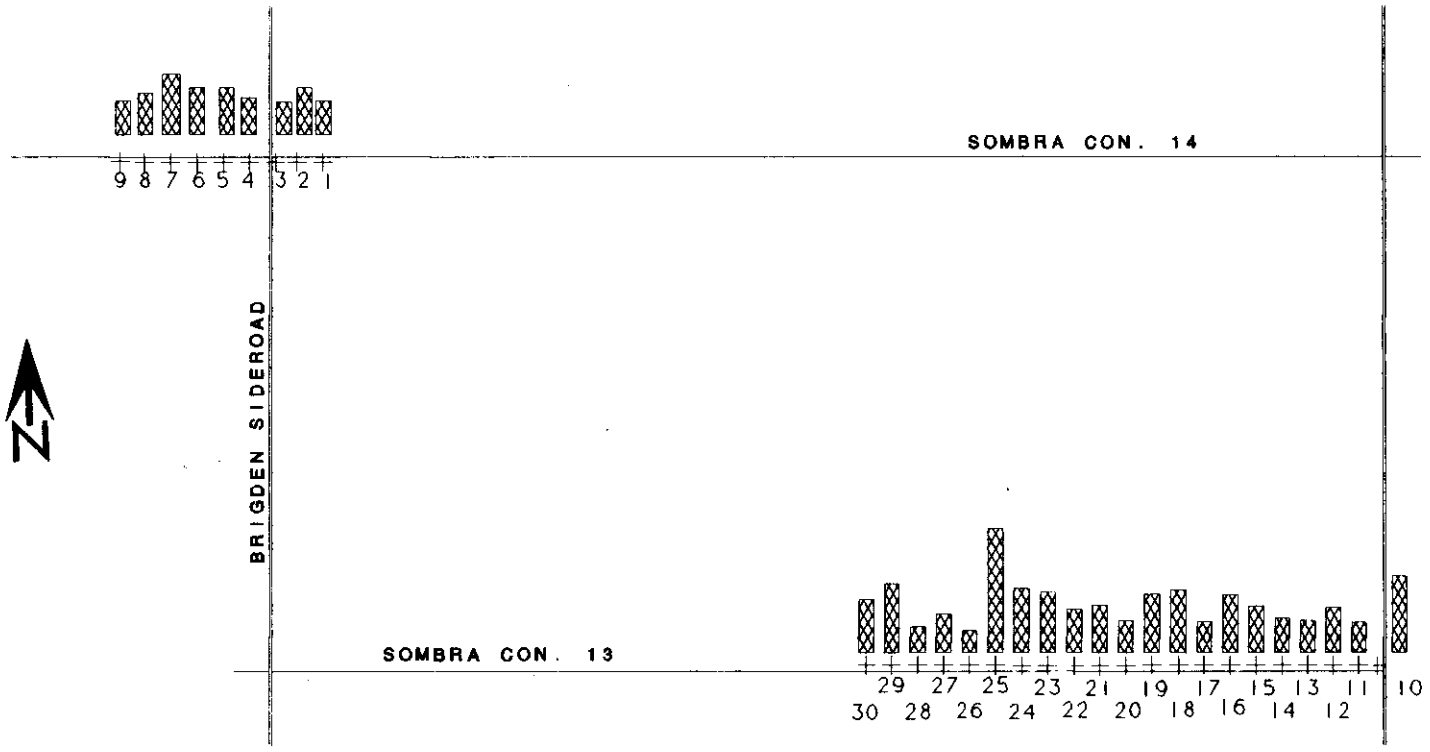


Figure CA2-2
Control Area 2: Soil Radon Gas Concentrations 1st and 2nd Intervals





LEGEND

+ 22 - *Station location and Number (all stations prefixed by CA-2)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*

metres

0 500 1000

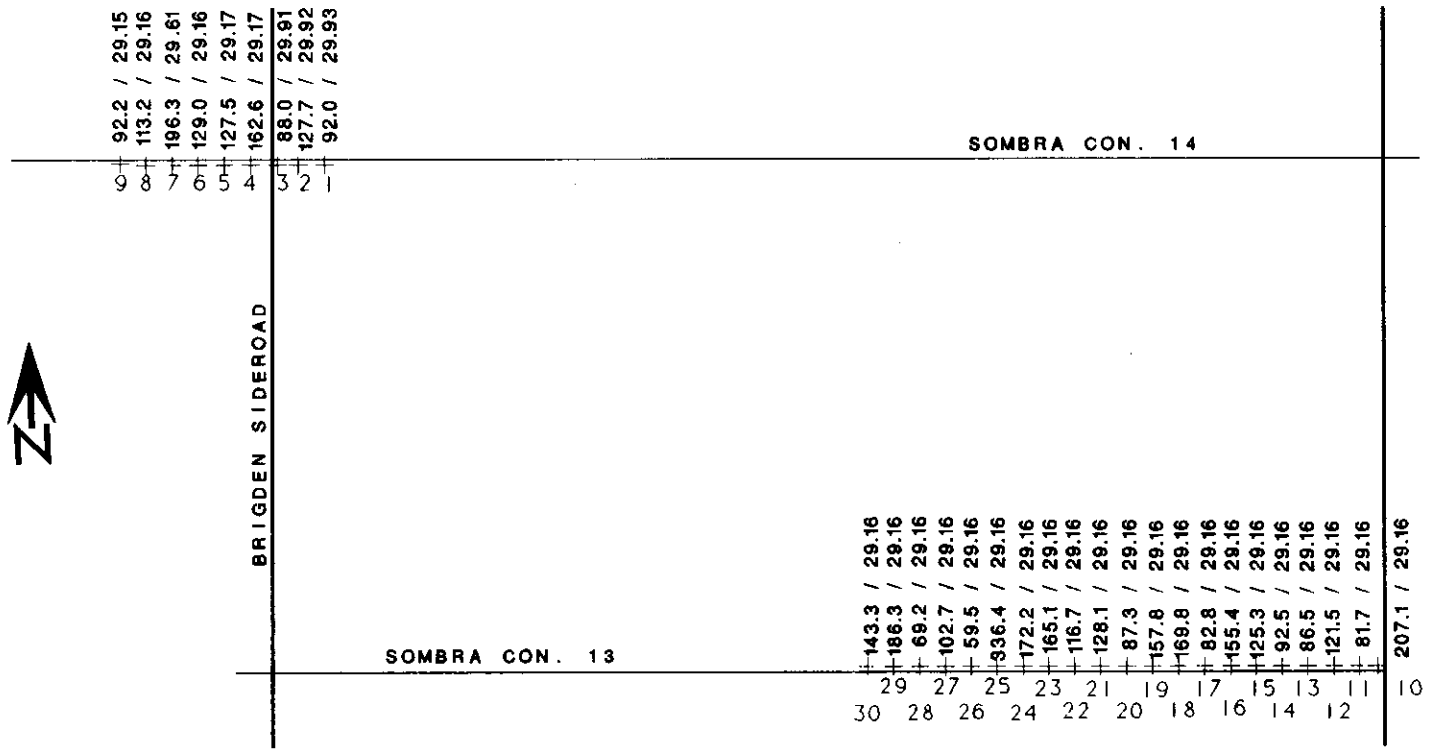
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 2

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CA2-3



LEGEND

+22 - *Station location and Number (all stations prefixed by CA-2)*

99.0/ 22.00 *Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*

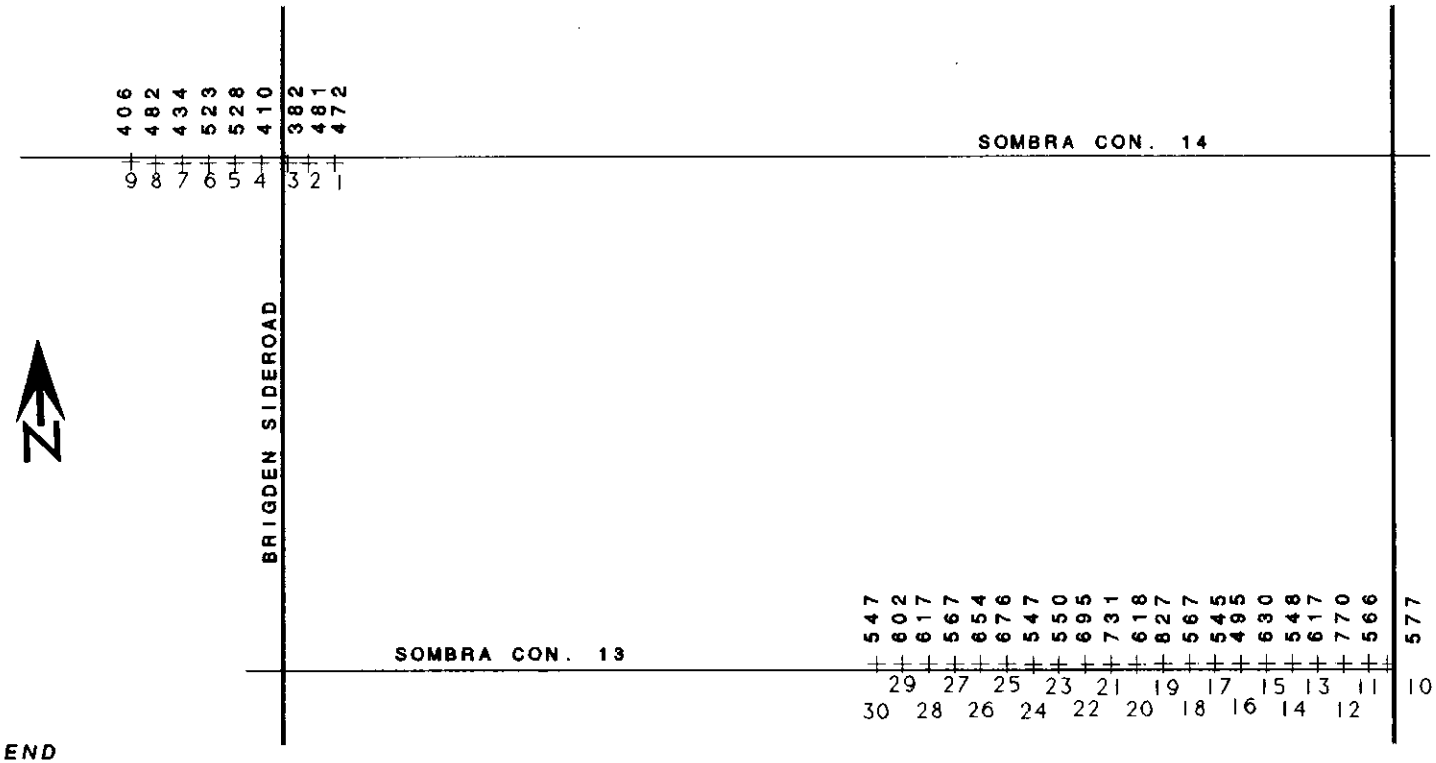
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 2

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CA2-4



LEGEND

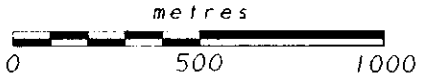
+ 22 - *Station location and Number (all stations prefixed by CA-2)*

545 *Radon Emanation Potential (pCi/kg)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 2

RADON EMANATION POTENTIAL RESULTS

Figure CA2-5

(CONTROL AREA 3, Faults with no known reserves/production)
Sombra Township, Concession V/VI, Lots 16, 17, 18, 19, 20, 21, 22
Figures CA3-1, CA3-2, CA3-3, CA3-4, CA3-5, CA3-6.

Location	U.T.M. 4721000N, 391000E 17T LT Sombra Township
Surficial Geology	Clay and silt veneer overlying black shale till
Drift Thickness	15 m to 29 m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Strata	N/A
Depth Below Surface	N/A
Type of Reservoir	N/A

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
197.2	538.5	53.9	137.1	518.7	669.0	339.0	80.9

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
184.3	554.9	40.3	143.2	198.5	501.6	47.5	137.7

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.86	0.82	-0.36	-0.62	-0.23	-0.41	-0.34	-0.58

The area outlined above lies in a region where black shale till is not known to be exposed at surface. A portion of the Dawn Fault on which there is no known hydrocarbon accumulation runs diagonally through these lots. Both the Sombra-Chatham township line and the township road between Concession V and VI cross the fault at a low angle.

Two sampling profiles were established across the fault trace. The first was located between Lambton County Highway #31 and the Brigden Sideroad on Sombra Concession V, and the second on the Brigden Sideroad at the intersection with Sombra Concession VI. Sixteen soil gas sample points were established on the Fifth Concession road and an additional 15 sample stations on the Brigden Sideroad. Soil samples were collected from the bottom of each radon in soil gas detector excavation.

Eighteen of the 31 sample locations were relatively well drained, most of these were on the east/west profile. Drainage is best along Sombra Concession V. West of the projected location of the

Dawn Fault soil gas concentrations were found to be in the order of 100 to 200 pCi/L, and over the fault trace values ranged from 350 pCi/L to 538 pCi/L.

The north-south profile shows only a small increase in soil gas radon concentration over the fault. The area is poorly drained and most sample locations were very wet to saturated. A slight increase in radon emanation potential was observed from the samples over the expected location of the Dawn Fault.

Figure CA3-1
Cotrol Area 3: Comparison between Soil Gas and Emanation Potential Results

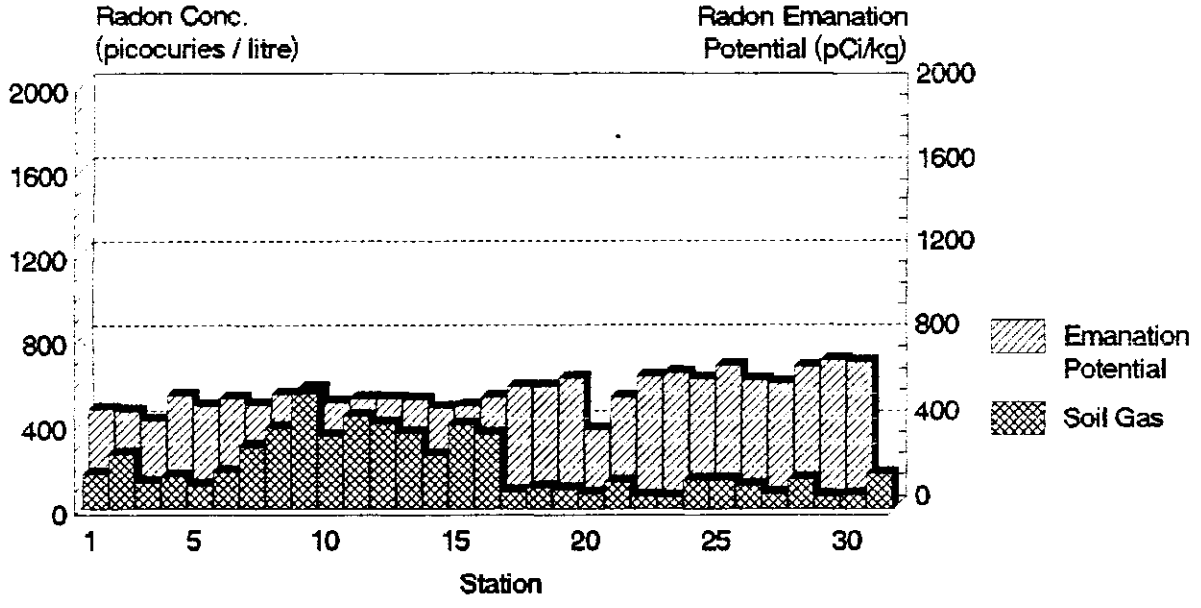
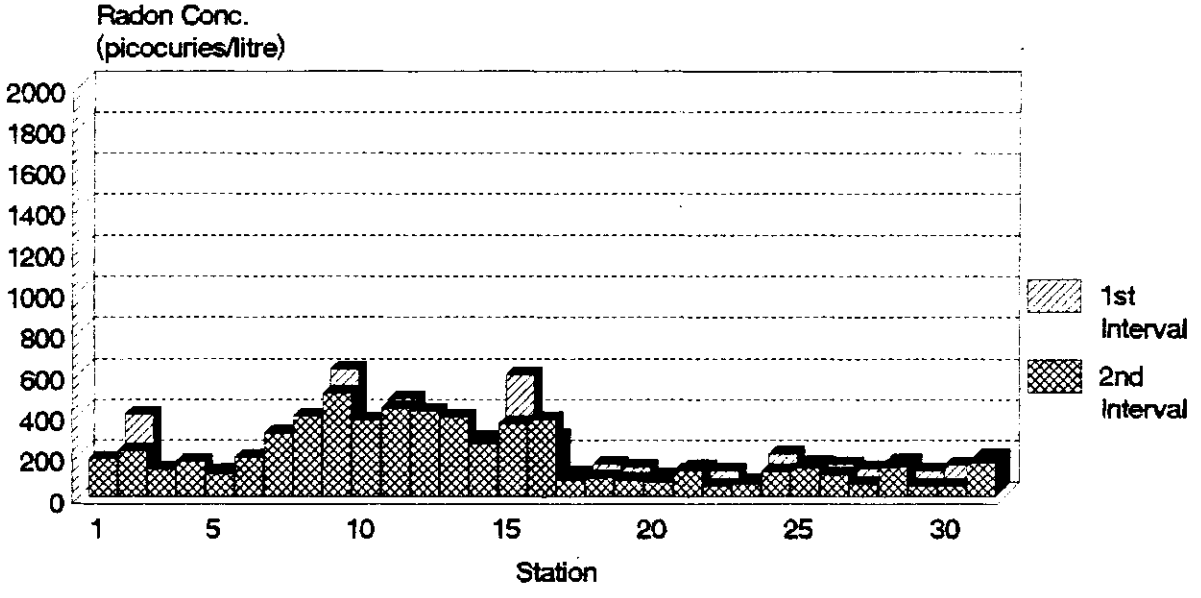
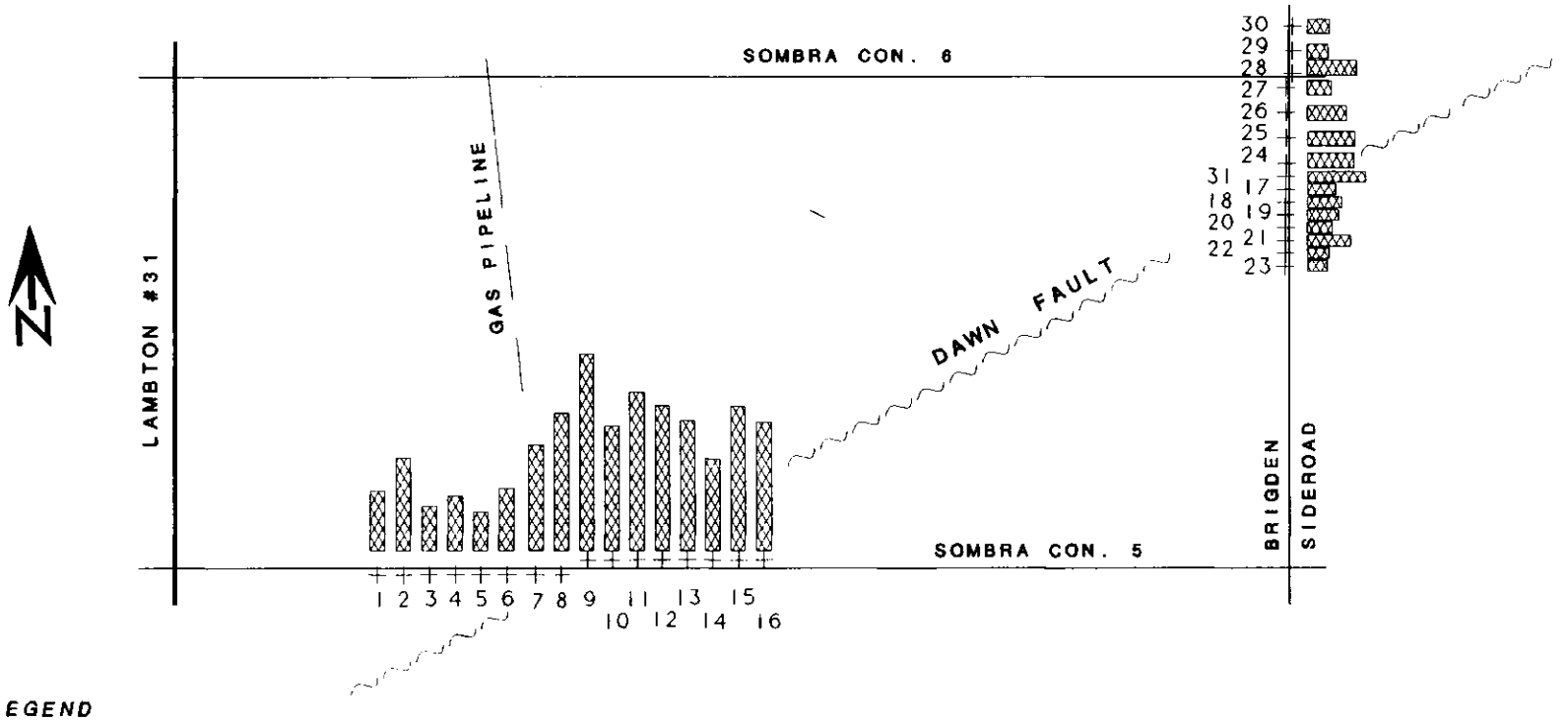


Figure CA3-2
Control Area 3: Soil Radon Gas Concentrations 1st and 2nd Intervals





LEGEND

+ 22 - *Station location and Number (all stations prefixed by CA-3)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

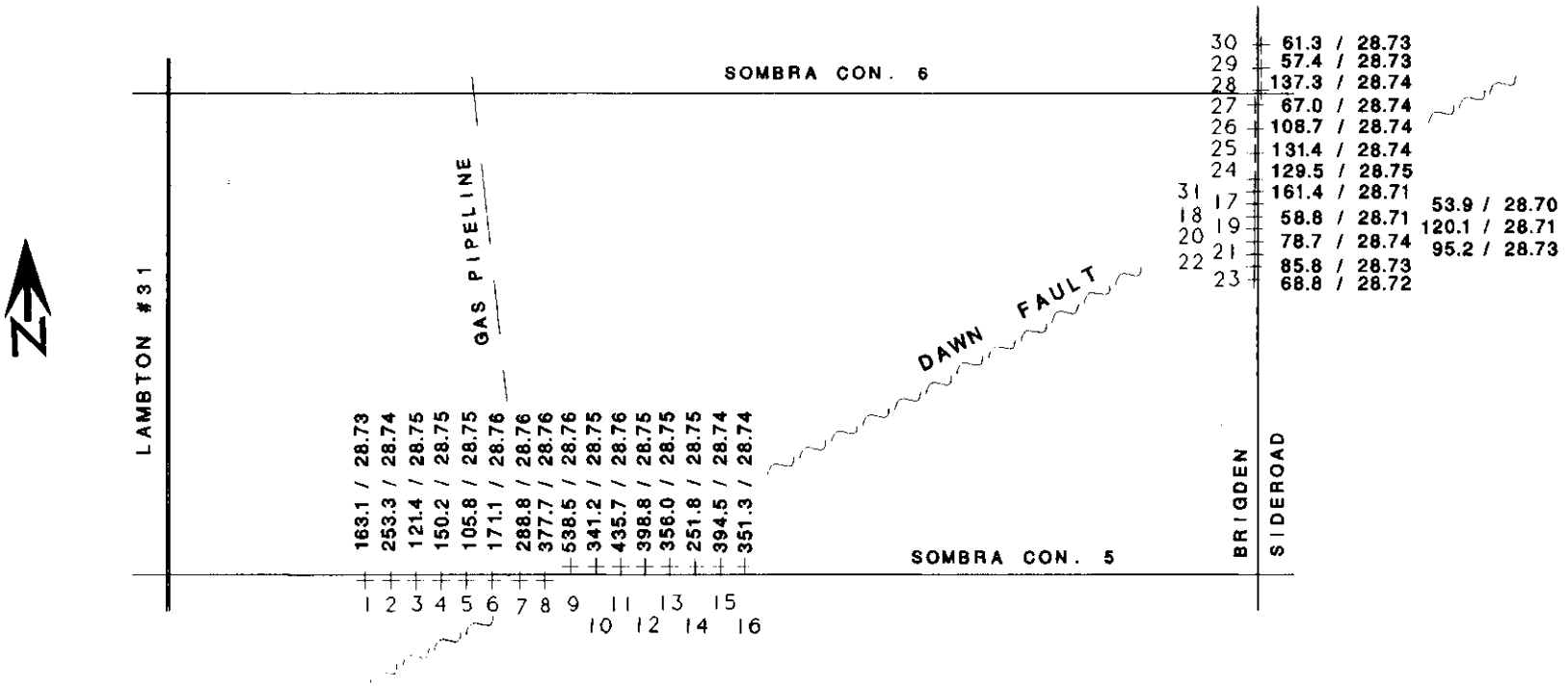
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 3

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CA3-3



LEGEND

+22 - *Station location and Number (all stations prefixed by CA-3)*

99.0/ 22.00 - *Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

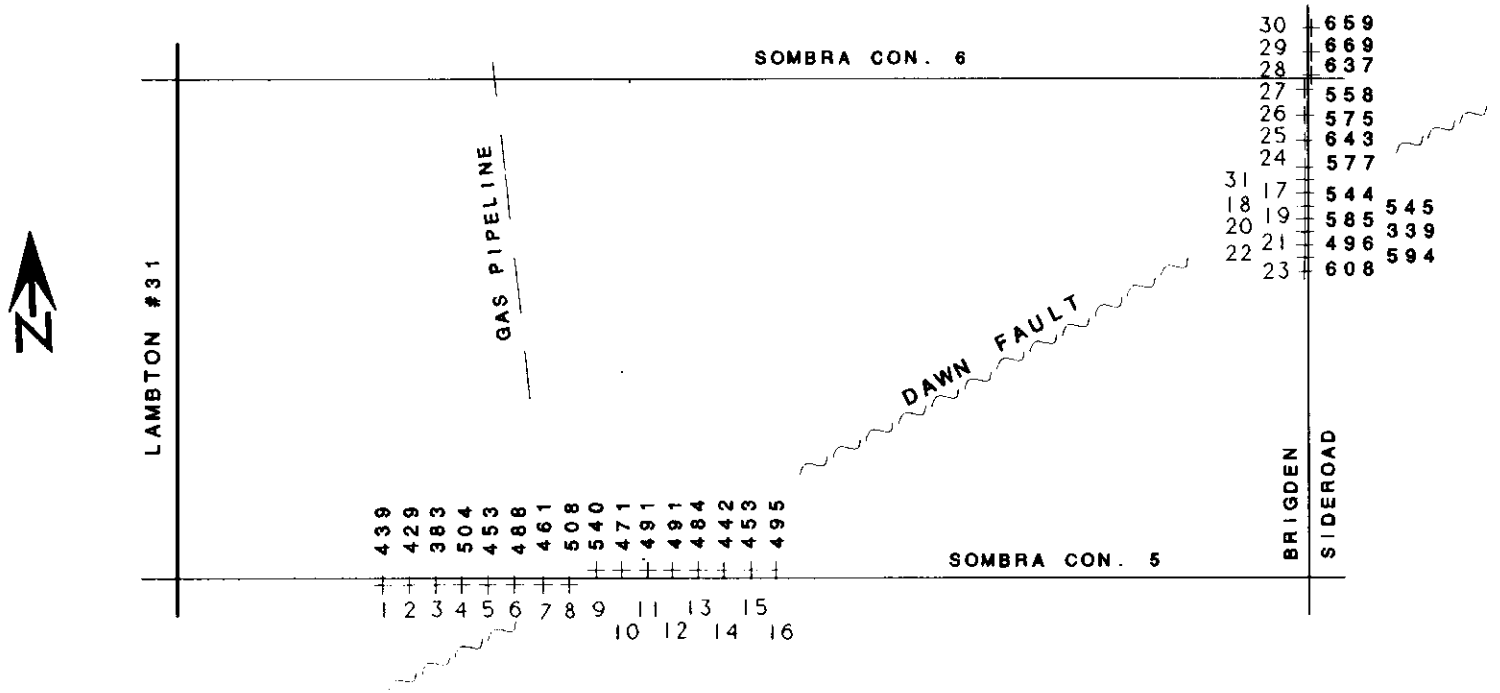
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 3

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CA3-4



LEGEND

- 22 - *Station location and Number (all stations prefixed by CA-3)*

545 *Radon Emanation Potential (pCi/kg)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres
0 500 1000

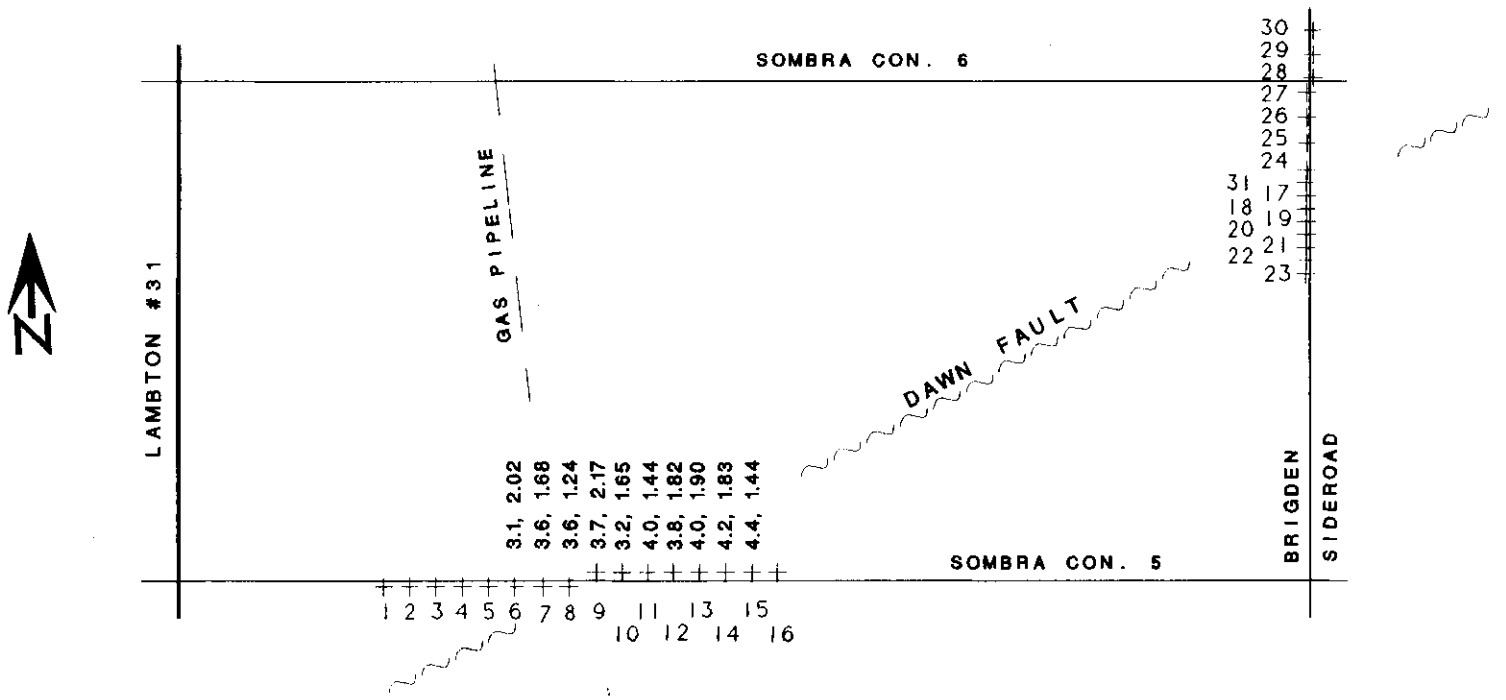
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 3

RADON EMANATION POTENTIAL RESULTS

Figure CA3-5



LEGEND

+22 - *Station location and Number (all stations prefixed by CA-3)*

1.8, 3.66 *Uranium (ppm), Radium (pCi/g)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CONTROL AREA 3

URANIUM AND RADIUM GEOCHEMICAL RESULTS

Figure CA3-6

CHATHAM GAS FIELD (Silurian)

Figures CH-1, CH-2, CH-3, CH-4, CH-5, CH-6.

Location	U.T.M. 4711000N, 395000E 17T LT
	Chatham Township Con. 12 and 13
Surficial Geology	Clay and silt veneer overlying
	Black shale till
Drift Thickness	~30m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Unit	A-1,2 Carbonates of Salina Fm.
Depth Below Surface	430 - 500m
Type of Reservoir	Structural trap

STATISTICAL SUMMARY

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
379.6	1615.9	59.2	358.8	243.0	495.8	77.8	108.2

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
292.0	898.9	71.1	178.6	288.8	378.0	94.0	59.5

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.58	0.17	0.19	1.18	0.08	0.16	0.25	0.64

The Chatham gas fields lie south of the Sydenham River about 6 to 8 km east-southeast of Wallaceburg, in the north part of Chatham Township. The productive area runs diagonally across Concessions IX, X, XI, XII, and XIII, between Oldfield and Turnerville.

The productive horizons are in Silurian rocks and are associated with the Electric Fault. Depth to traps is in the order of 430 to 500 m.

The fields are crossed by township roads that run at about 45° to their long axis providing convenient profile lines. The locations of sampling points are shown in figures CH-3, CH-4, and CH-5.

This area has relatively well drained loamy soil. Soil radon gas concentrations are variable and

appear to be highest at or near the edges of the known hydrocarbon fields. The southern profile also shows an increase in soil gas radon levels in the central portion of the field.

Figure CH-1
Chatham Gas Field: Comparison between
Soil Gas and Emanation Potential Results

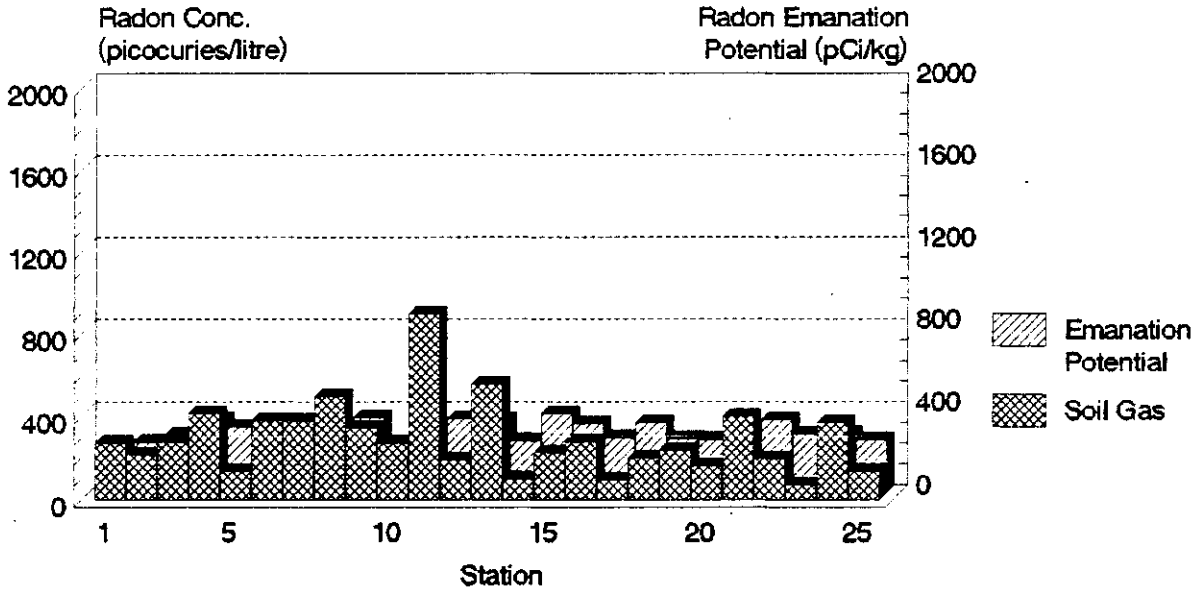
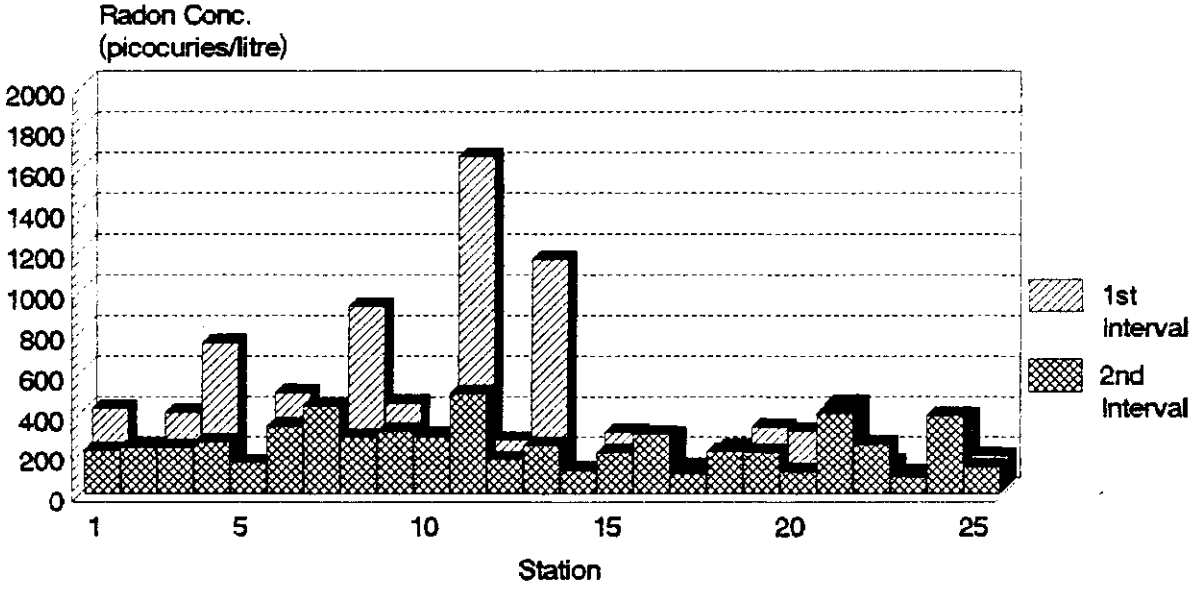
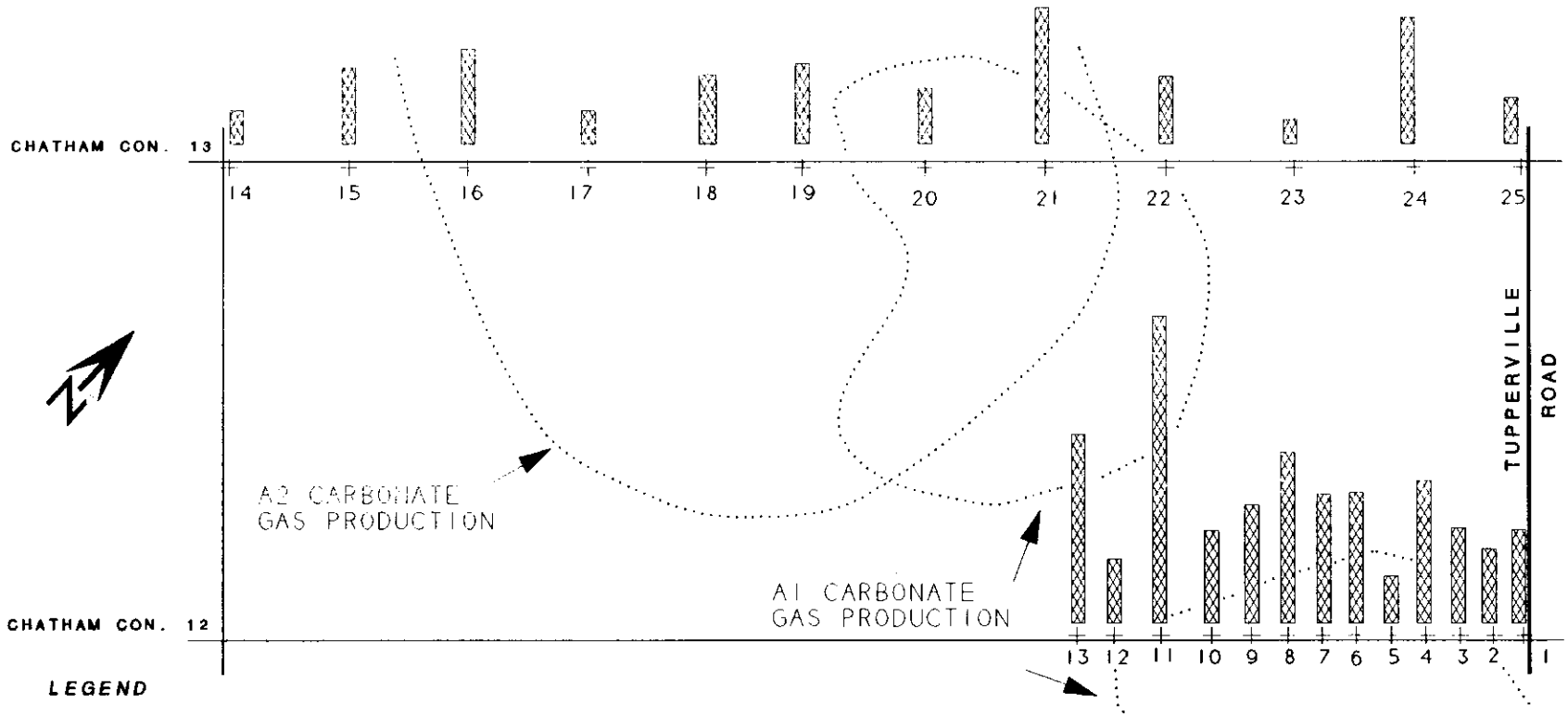


Figure CH-2
Chatham Gas Field: Soil Radon Gas
Concentrations 1st and 2nd Intervals





LEGEND

+ 22 - *Station location and Number (all stations prefixed by CH)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

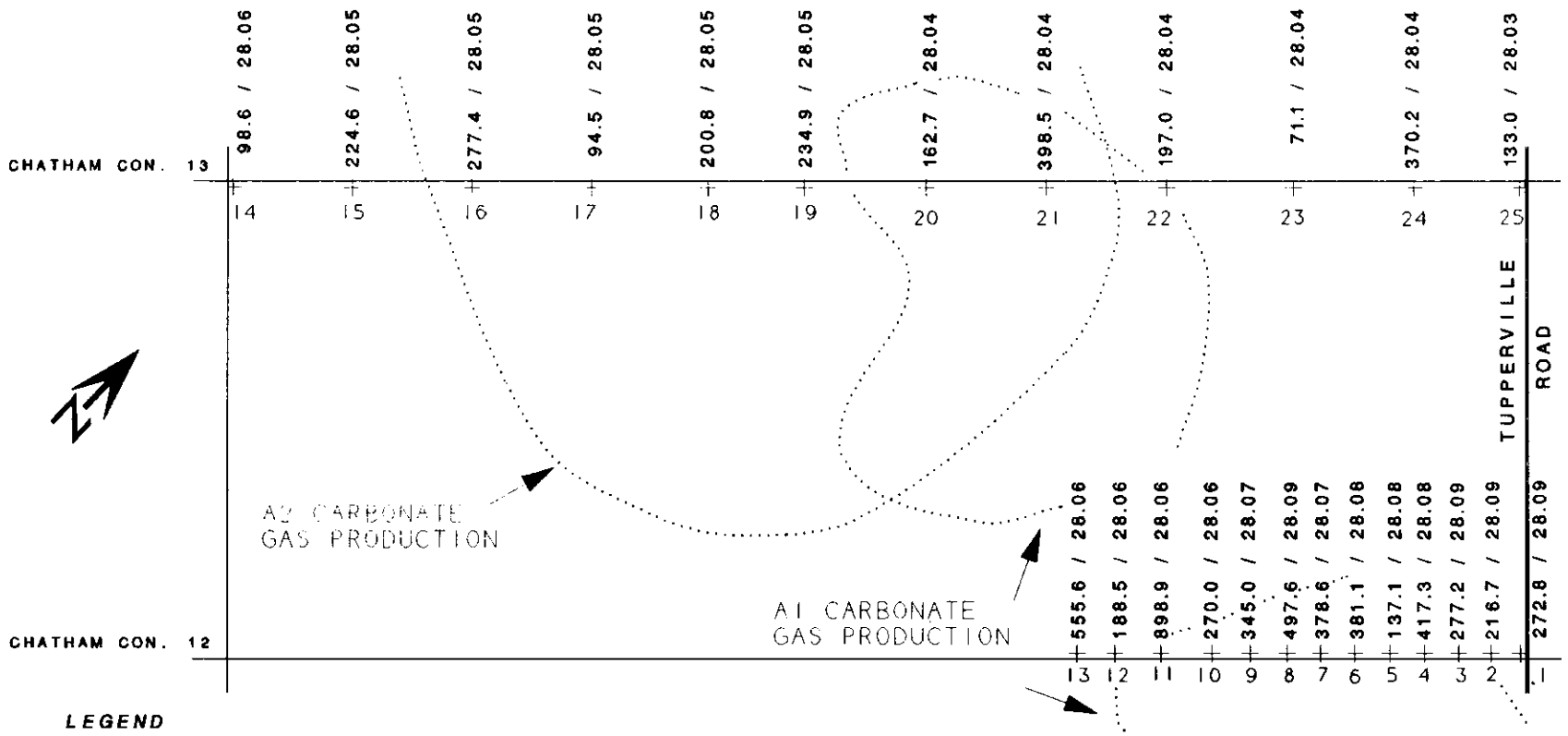
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CHATHAM GAS FIELD

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CH-3



LEGEND

+ 22 - *Station location and Number (all stations prefixed by CH)*

99.0/ 22.00 - *Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

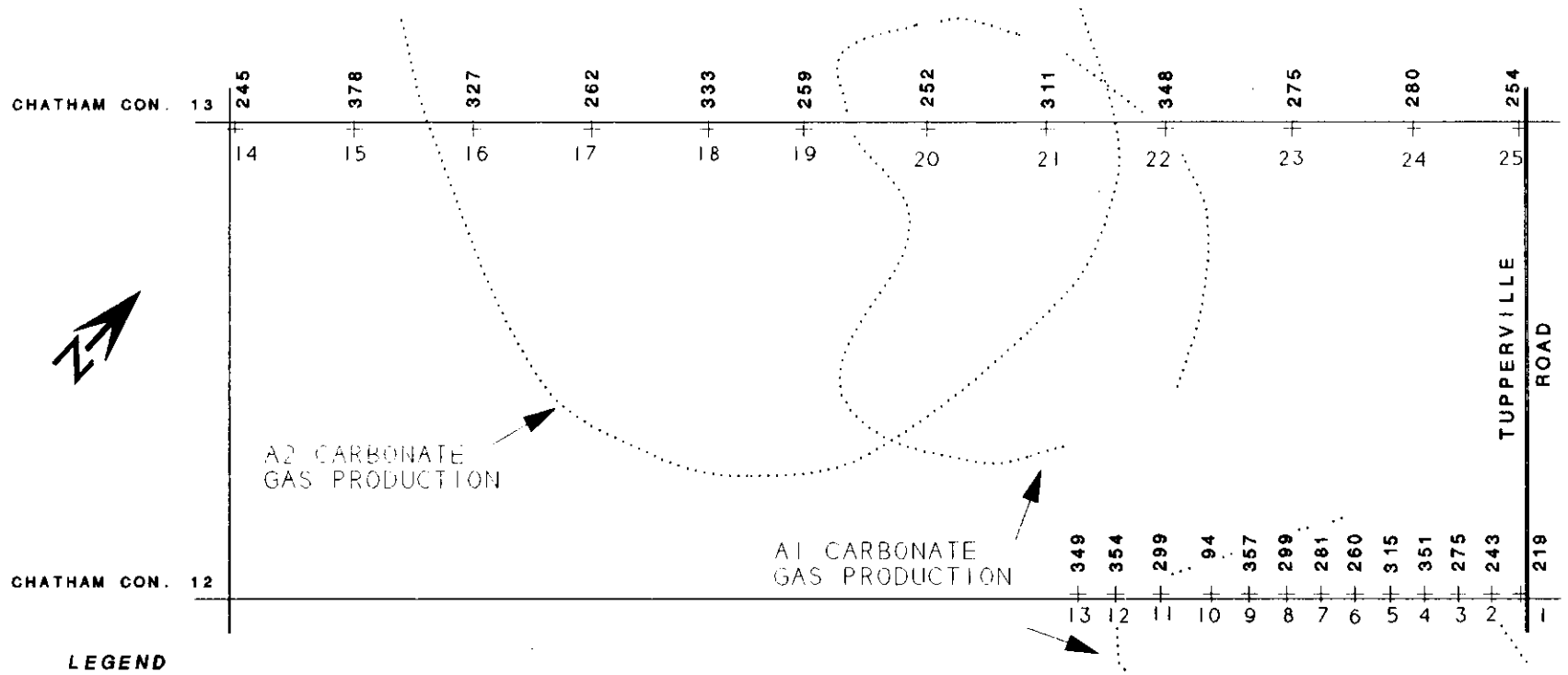
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CHATHAM GAS FIELD

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CH-4



LEGEND

+ 22 - *Station location and Number (all stations prefixed by CH)*

545 *Radon Emanation Potential (pCi/kg)*

Boundary of Oil or Gas Field

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

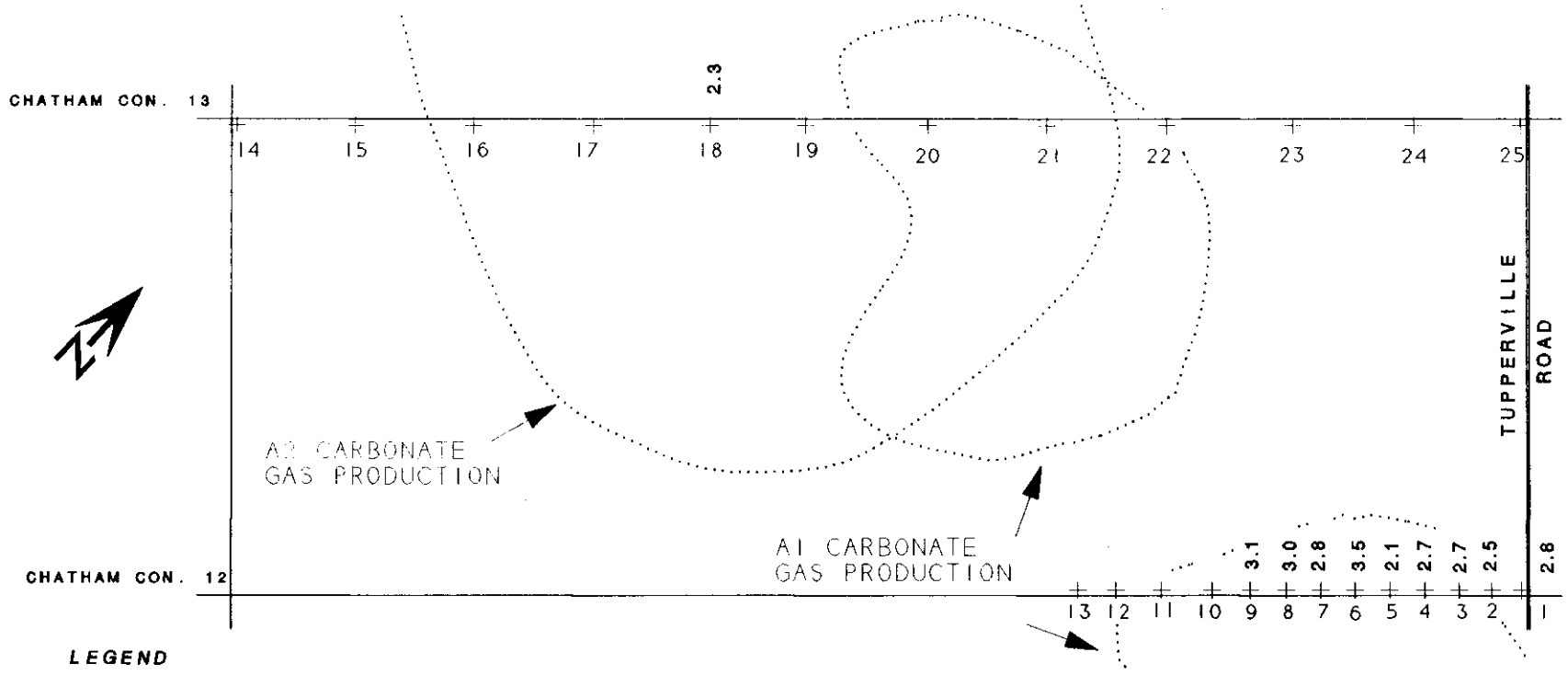
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CHATHAM GAS FIELD

RADON EMANATION POTENTIAL RESULTS

Figure CH-5



LEGEND

+ 22 - *Station location and Number (all stations prefixed by CH)*

1.8 *Uranium (ppm)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CHATHAM GAS FIELD

URANIUM GEOCHEMICAL RESULTS

Figure CH-6

CLEARVILLE FIELD (Cambrian, faulted)

Figures CL-1, CL-2, CL-3, CL-4, CL-5.

Location	U.T.M. 4704000N, 442000E 17T MT
Surficial Geology	Till and sand silt clay veneer
Drift Thickness	45m to 55m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Strata	Cambrian - Trempealeau Formation
Depth Below Surface	3800′
Type of Reservoir	Structural - fault bounded block

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
72.8	278.2	13.5	48.5	196.4	649	27	104.0

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
77.1	235.2	15.0	41.0	71.8	297.1	9.8	57.9

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.62	0.87	0.02	0.01	-0.02	0	0.01	0

The Clearville field is located in the southeast corner of Orford Township about 3 km north of Lake Erie. The field extends slightly into Aldborough Township, Concession XIII. Talbot Road (Hwy. 3) crosses the field in Lots 52 to 57.

The trap lies in an up-thrown block bounded by 3 identified faults. The bottom of the productive zone is at approximately 1008 m below sea level, and the top of the productive zone is at about 994 m below sea level. The depth to the top of the zone is approximately 1200 m.

The throw on the west boundary fault is ~40 m, while the northwest boundary fault shows about 15 m displacement. The east boundary fault has ~7 m displacement.

The gas-bearing portion of the field lies north of Talbot Road, and does not have public access.

A profile along Talbot Road was completed, along with traverses north into the central portion of the field and traverses across the faulted northern boundary. Station spacing was ~100 m through the central part of the field. Closer spacing over the east boundary and northwest boundary faults required an additional 8 to 10 stations. A soil sample profile was run into the heart of the field from Talbot Road, but no soil gas detectors were placed due to flooded soil conditions.

At each site soil samples were collected and soil gas monitors were installed. Laboratory determination of Rn emanation potential was carried out on soil samples. Results are shown in figures CL-3, CL-4, and CL-5.

The area has several areas of moderate to good drainage. The central part of the field is flat agricultural land that was water saturated at the time of the survey. Radon in soil gas results are generally low with slight increases near the interpreted position of field boundary faults.

The apparent radium values for this area are also low. Depth of burial of the petroleum trap is, as noted above, ~1200 m. However, there are slightly elevated values for both soil gas radon and apparent radium associated with the traces of boundary faults.

Figure CL-1
Clearville: Comparison between Soil
Gas and Emanation Potential Results

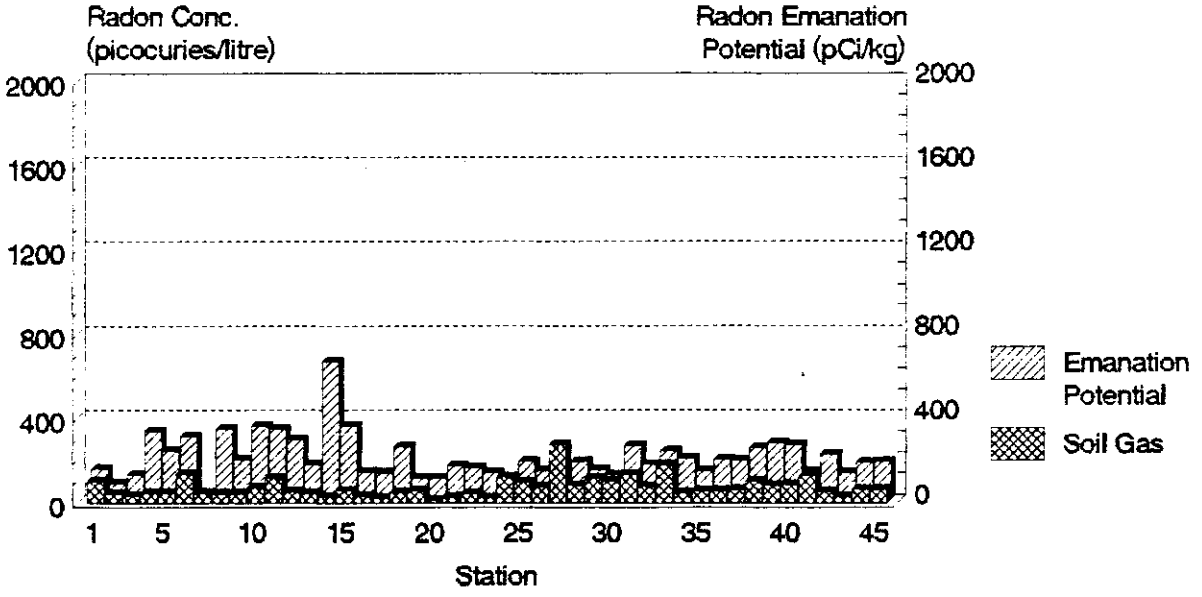
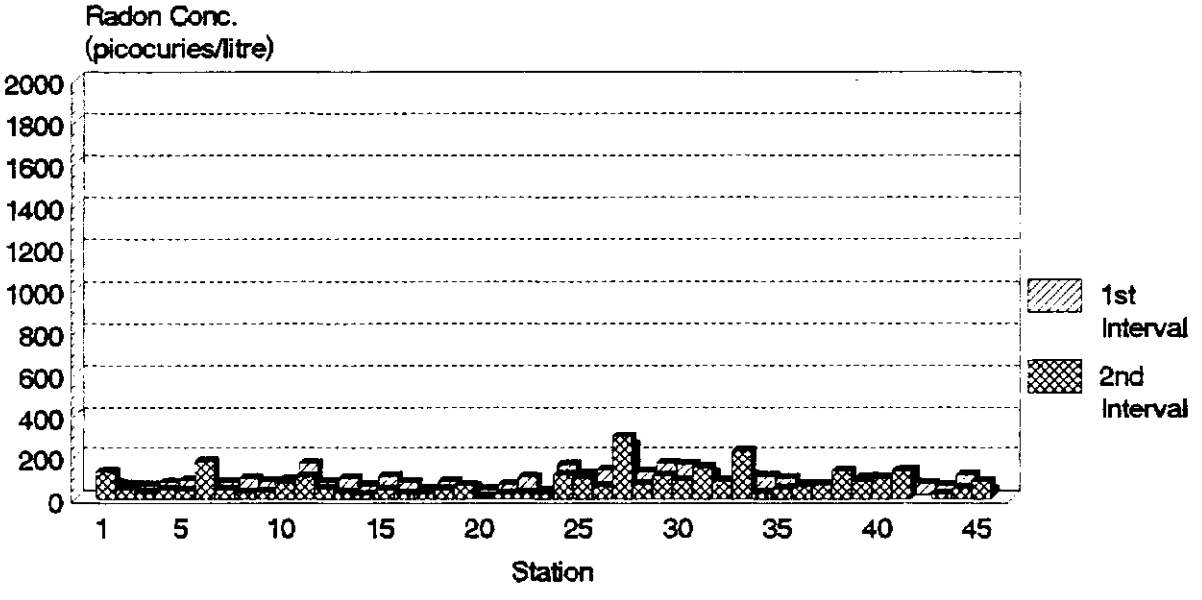


Figure CL-2
Clearville: Soil Radon Gas
Concentrations 1st and 2nd Intervals



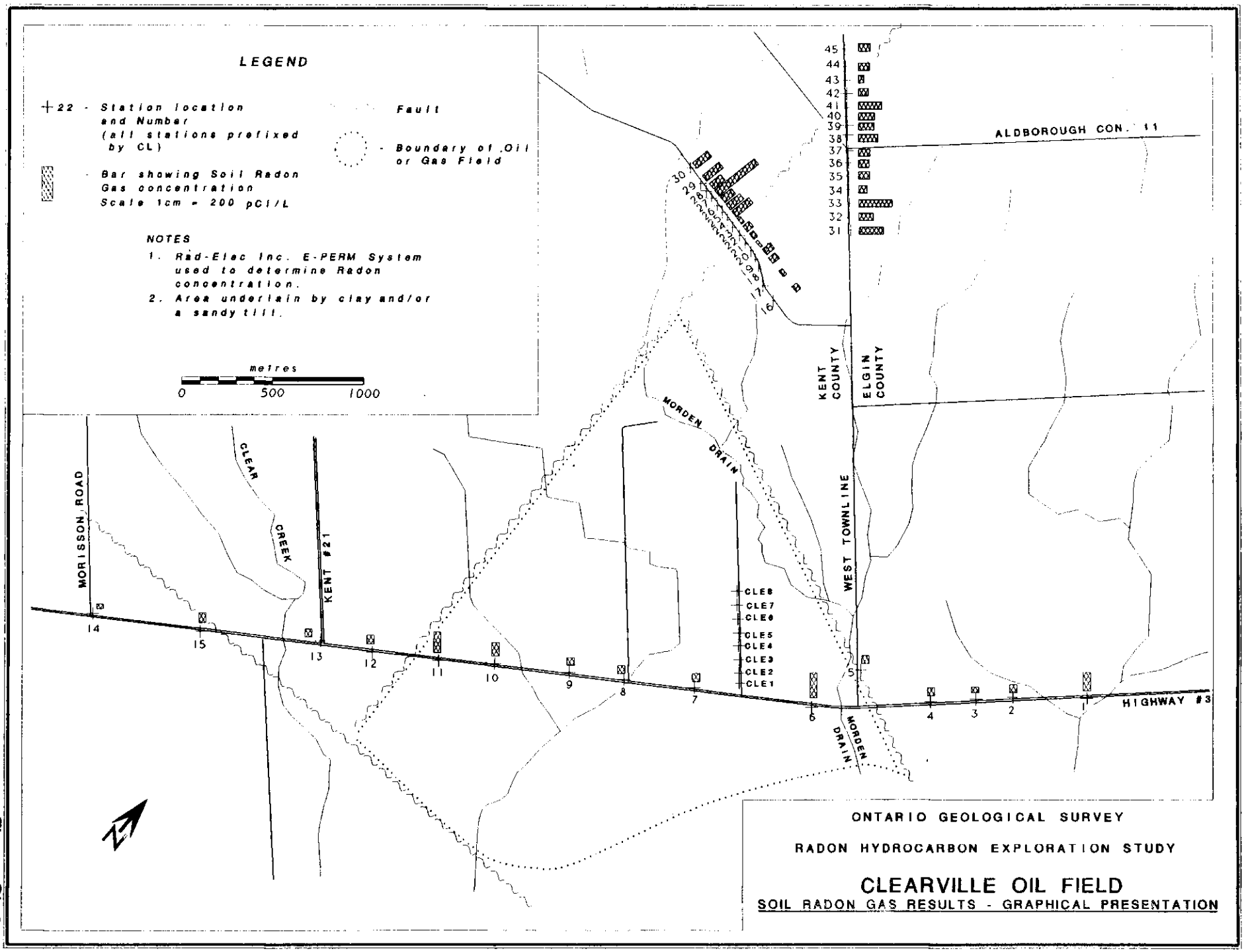

LEGEND
+22 - Station location and Number (all stations prefixed by CL)
- Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L
Fault
- Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by clay and/or a sandy till.
metres
0
500
1000
ALDBOROUGH CON. 11
KENT COUNTY
ELGIN COUNTY
WEST TOWNLINE
MORISSON ROAD
CLEAR CREEK
KENT #21
MORDEN DRAIN
HIGHWAY #3
CLE8
CLE7
CLE6
CLE5
CLE4
CLE3
CLE2
CLE1
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
CLEARVILLE OIL FIELD
SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CL-3

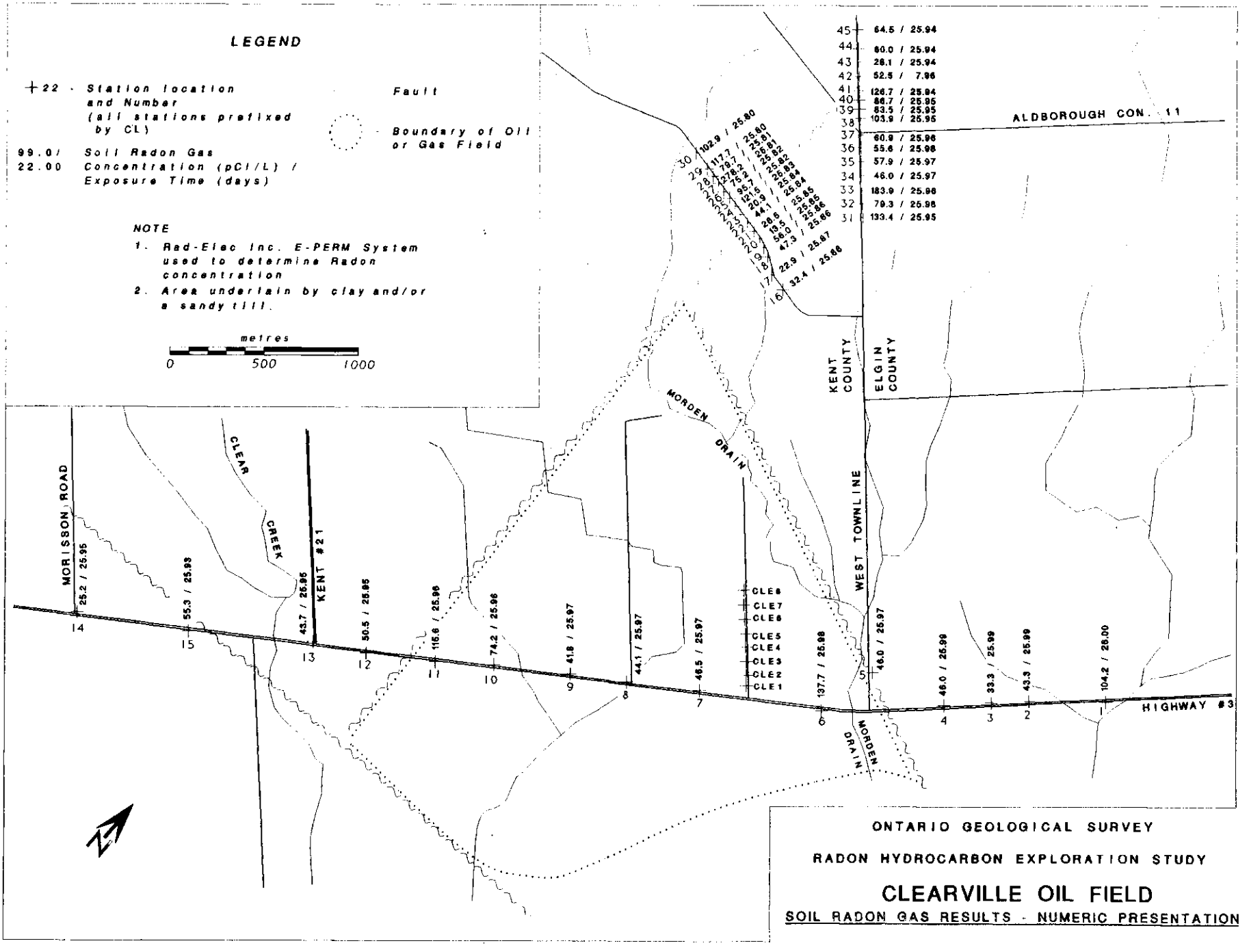
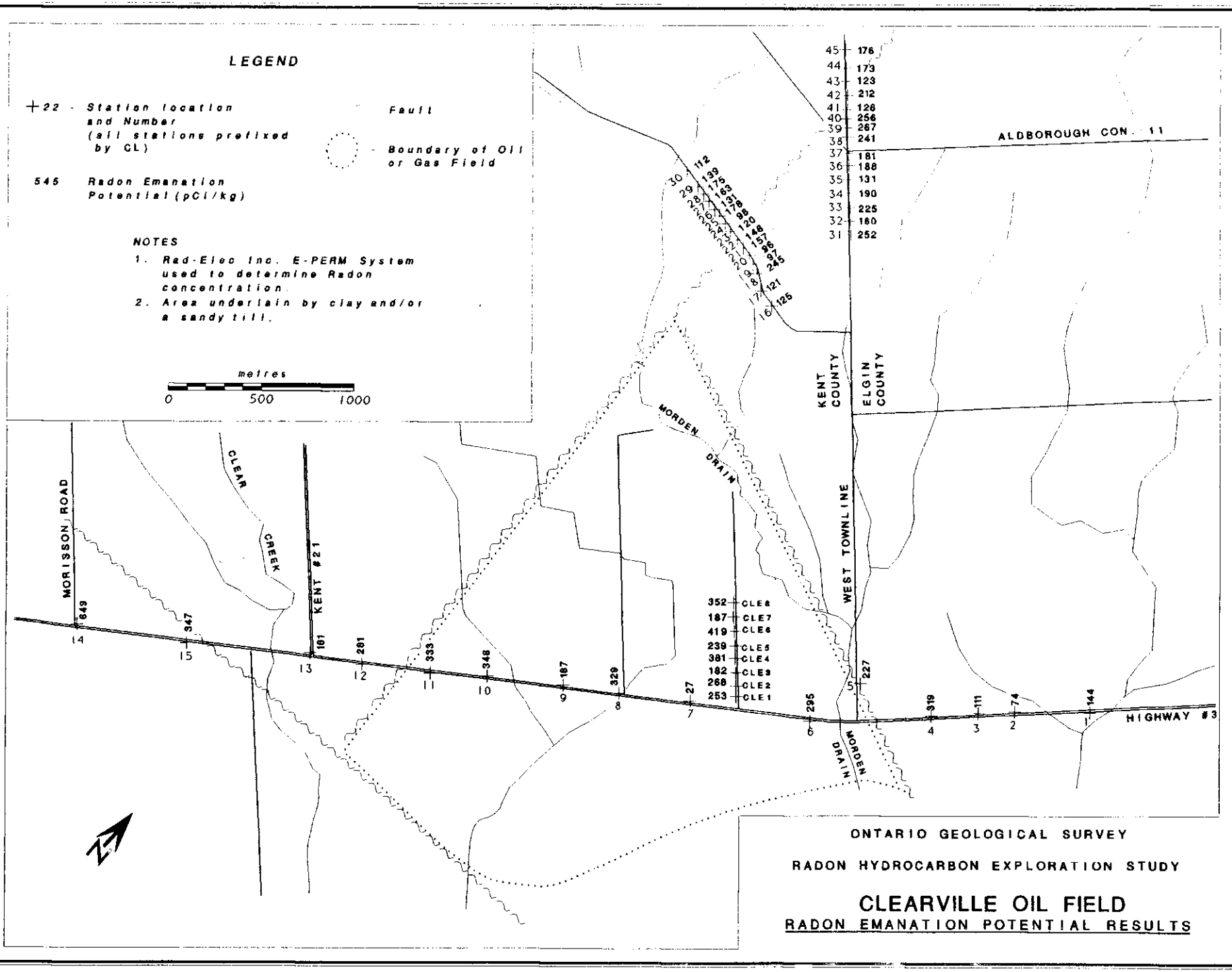

LEGEND
+22 - Station location and Number (all stations prefixed by CL)
99.0/ 22.00 Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)
Fault
Boundary of Oil or Gas Field
NOTE
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration
2. Area underlain by clay and/or a sandy till.
metres
0 500 1000
ALDBOROUGH CON. 11
KENT COUNTY
ELGIN COUNTY
MORRISON ROAD
CLEAR CREEK
KENT #21
MORDEN DRAIN
WEST TOWNLINE
HIGHWAY #3
CLE8
CLE7
CLE6
CLE5
CLE4
CLE3
CLE2
CLE1
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
CLEARVILLE OIL FIELD
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CL-4


LEGEND
+22 - Station location and Number (all stations prefixed by CL)
545 Radon Emanation Potential (pCi/kg)
Fault
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by clay and/or a sandy till.
metres
0 500 1000
ALDBOROUGH CON. 11
KENT COUNTY
ELGIN COUNTY
WEST TOWNLINE
MORISSON ROAD
CLEAR CREEK
KENT #21
MORDEN DRAIN
HIGHWAY #3
45 176
44 173
43 123
42 212
41 126
40 256
39 267
38 241
37 181
36 188
35 131
34 190
33 225
32 180
31 252
30 112
29 139
28 175
27 163
26 131
25 178
24 98
23 120
22 148
21 157
20 96
19 97
18 245
17 121
16 125
352 CLE8
187 CLE7
419 CLE6
239 CLE5
381 CLE4
182 CLE3
268 CLE2
253 CLE1
649
347
161
281
333
348
187
329
27
295
227
319
111
74
144
14
15
13
12
11
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N
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
CLEARVILLE OIL FIELD
RADON EMANATION POTENTIAL RESULTS

Figure CL-5

COVENY FIELD (Silurian incipient reef)

Figures CO-1, CO-2, CO-3, CO-4, CO-5, CO-6.

Location	U.T.M. 4727100N, 390500E 17T LT Sombra Township Con 12
Surficial Geology	Clay and silt veneer overlying black shale till, and Black Shale Till
Drift Thickness	~30m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Unit	Guelph Formation dolomite
Depth Below Surface	590m
Type of Reservoir	Incipient reef

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
136.5	644.9	40.9	111.0	455.4	955.0	248.0	126.2

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
134.4	701.8	37.1	133.6	135.0	606.4	38.5	105.0

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.84	0.66	0.68	0.57	0.55	0.58	0.67	0.58

The Coveny pool lies in Concessions XI and XII, Lots 14, 15 and 16, Sombra Township, about 2 km south of Wilkesport on the North Sydenham River.

The productive level lies between 590 and 630 meters below surface. It is described as an incipient reef, with hydrocarbon accumulation along about 1 km on the long (NE) axis.

Two soil gas and soil sample profiles were established, one along the east-trending highway (Lambton County Road #2) and the other along the north-trending township road (Lambton County Road #31). Thirty soil gas locations were established and 30 soil samples were taken from the detector deployment holes.

The north-running profile is generally poorly drained, while sample points on the east-trending profile were located along a deep drainage ditch and the soils were well drained.

The highest soil gas radon levels occured in the east-west profile near the edge of the gas field (644.9 pCi/L). Radon emanation potential values show some variability with highest results coincident with the highest soil gas radon results.

Figure CO-1

Coveny Gas Field: Comparison between
Soil Gas and Emanation Potential Results

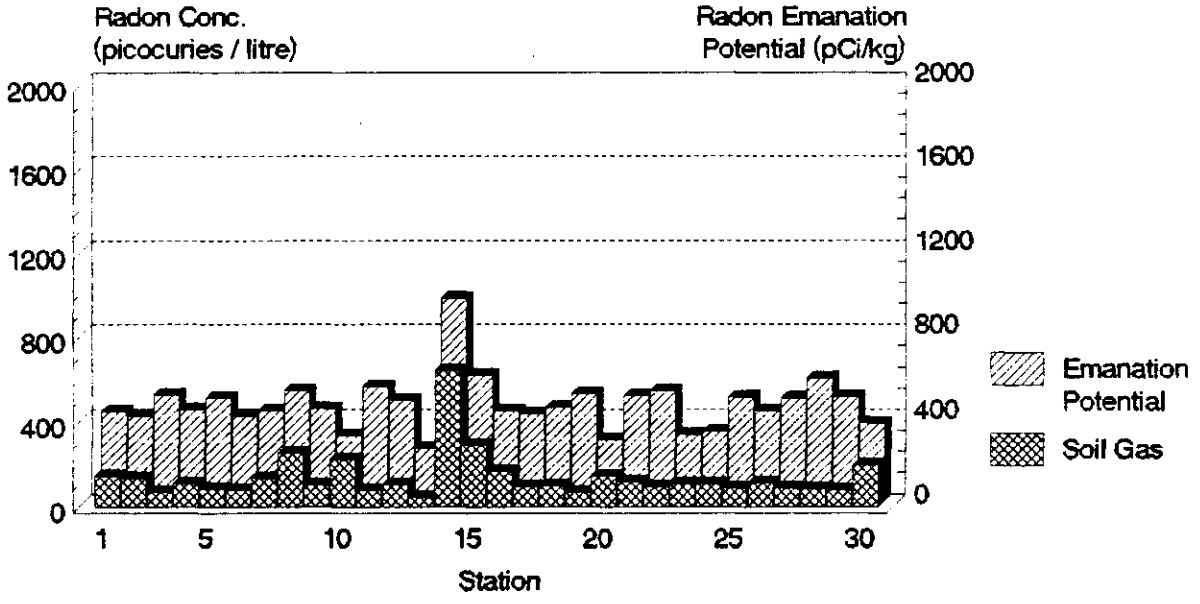
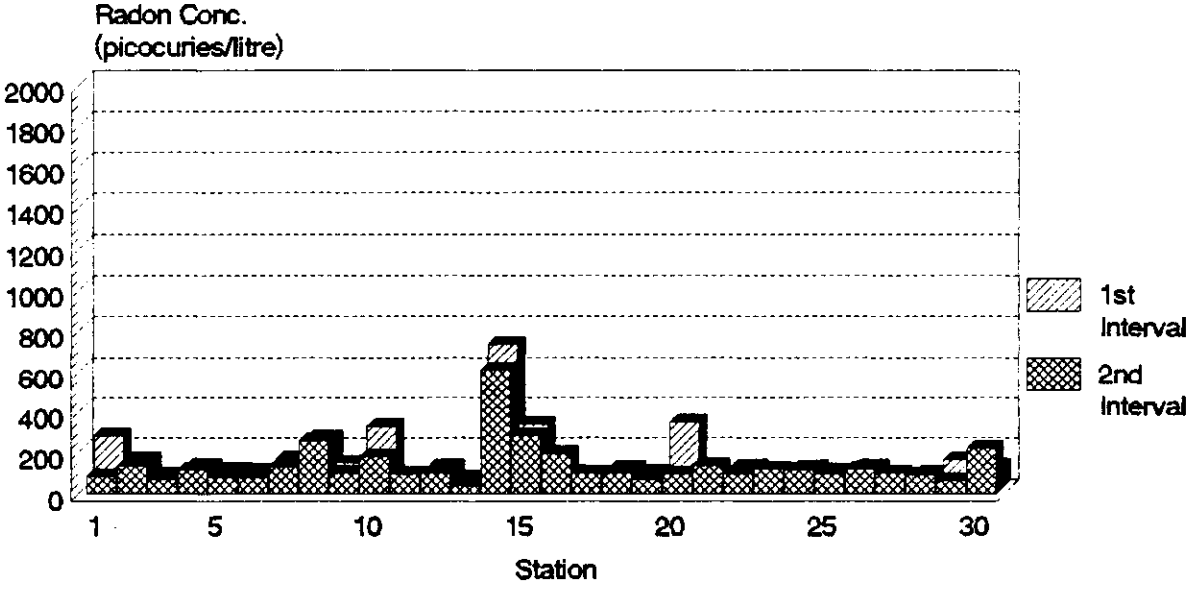
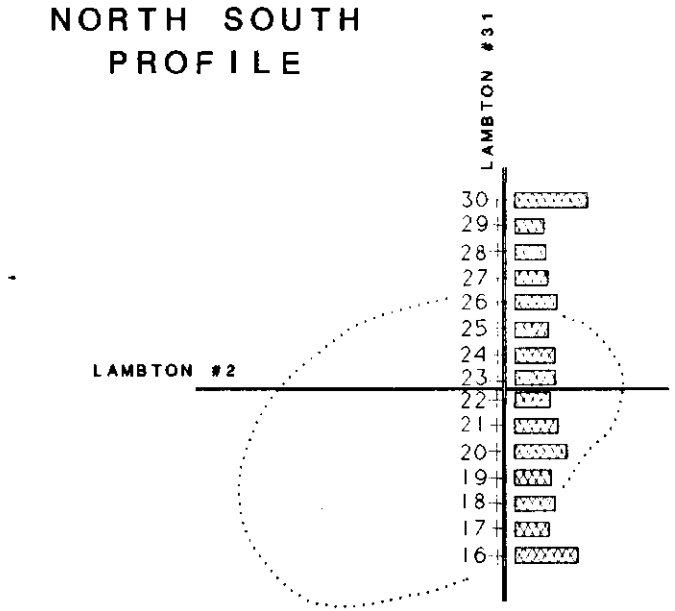
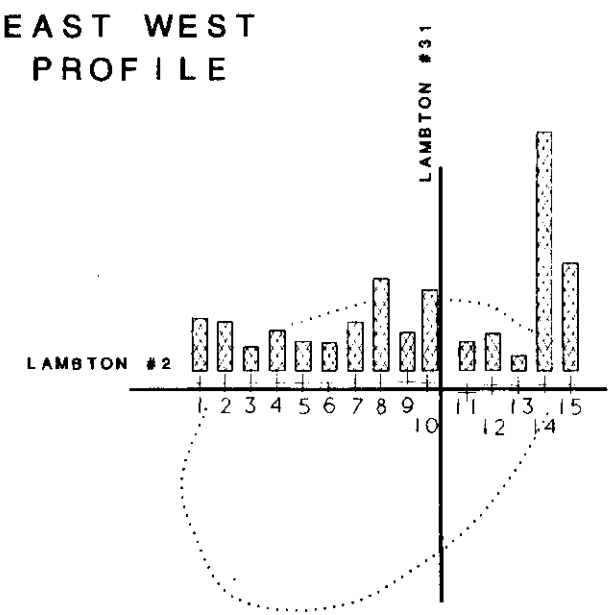


Figure CO-2

Coveny Gas Field: Soil Radon Gas
Concentrations 1st and 2nd Intervals







LEGEND

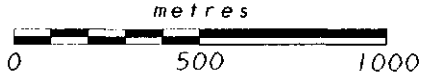
+ 22 - *Station location and Number (all stations prefixed by CO)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



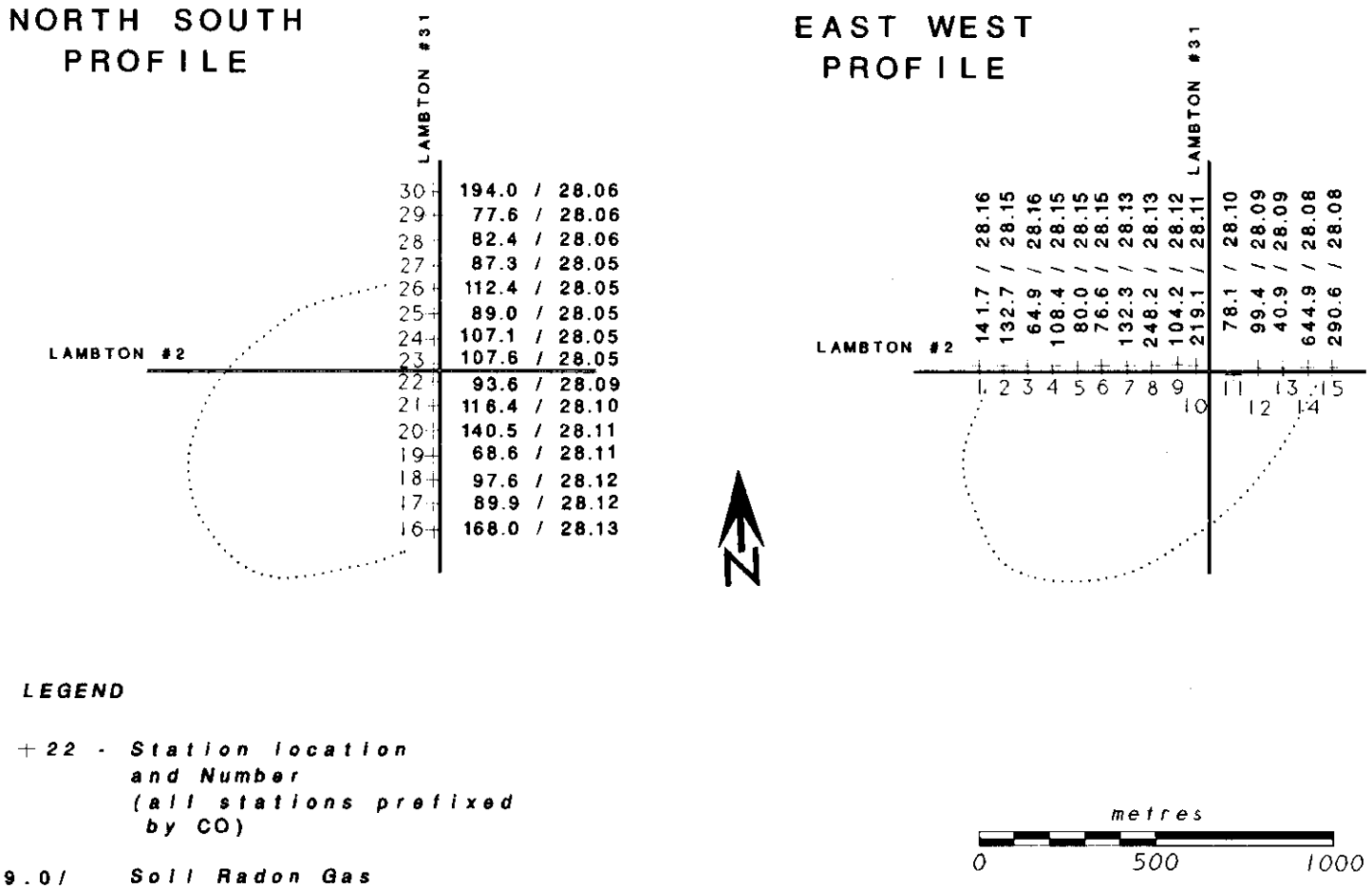
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

COVENY GAS FIELD

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure CO-3



LEGEND

+22 - *Station location and Number (all stations prefixed by CO)*

99.0/22.00 - *Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*

ONTARIO GEOLOGICAL SURVEY

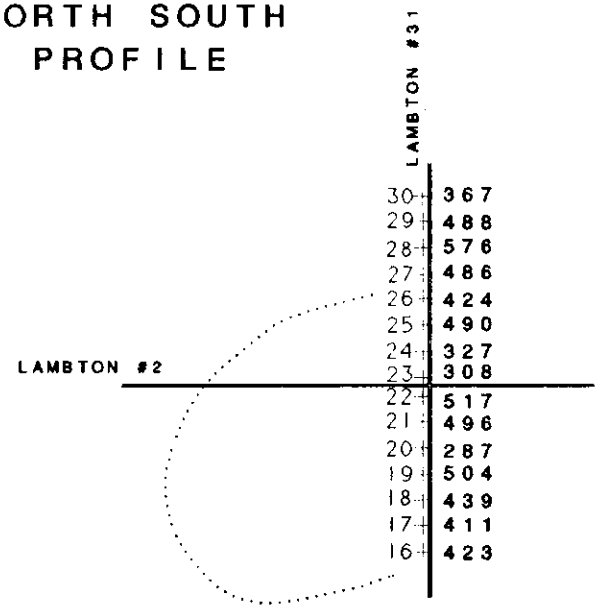
RADON HYDROCARBON EXPLORATION STUDY

COVENY GAS FIELD

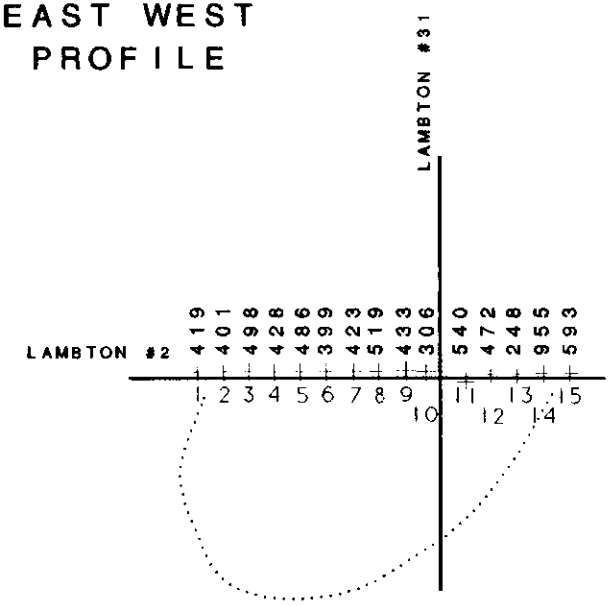
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure CO-4

NORTH SOUTH PROFILE



EAST WEST PROFILE



LEGEND

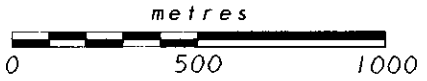
+ 22 - *Station location and Number (all stations prefixed by CO)*

545 *Radon Emanation Potential (pCi/kg)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



ONTARIO GEOLOGICAL SURVEY

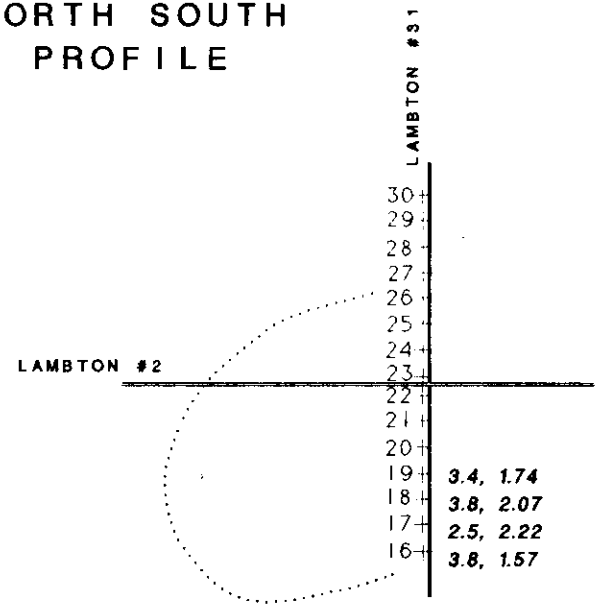
RADON HYDROCARBON EXPLORATION STUDY

COVENY GAS FIELD

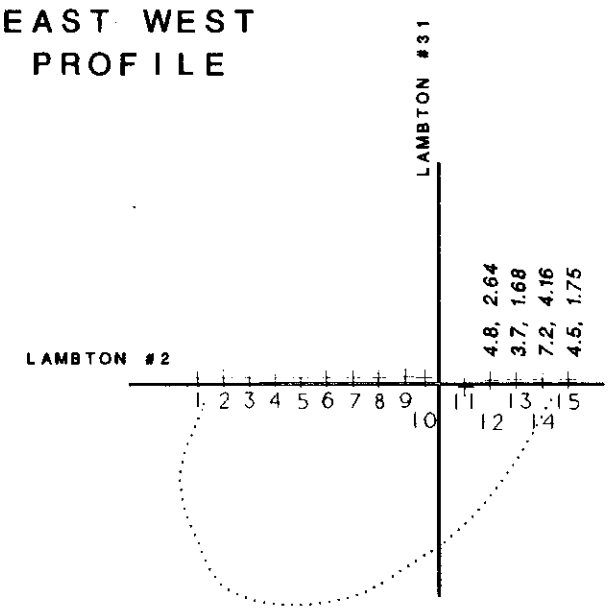
RADON EMANATION POTENTIAL RESULTS

Figure CO-5

NORTH SOUTH PROFILE



EAST WEST PROFILE



LEGEND

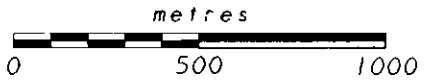
+ 22 - *Station location and Number (all stations prefixed by CO)*

1.8, 3.66 *Uranium (ppm), Radium (pCi/g)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

COVENY GAS FIELD

URANIUM AND RADIUM GEOCHEMICAL RESULT

Figure CO-6

DAWN GAS FIELD (Silurian, on Dawn Fault)
Figures DG-1, DG-2, DG-3A, DG-3B, DG-4A, DG-4B, DG-5A, DG-5B, DG-6A, DG-6B.

Location	U.T.M. 4729000N, 409000E 17T MT Dawn Township, Conc. 6 to 10
Surficial Geology	black shale till
Drift Thickness	15 m to 25 m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Unit	?
Depth Below Surface	~480 m
Type of Reservoir	Structural, fault

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
295.5	683.8	103.6	158.8	924.2	1308.0	608.0	189.6

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
134.4	701.8	37.1	133.6	135.0	606.4	38.5	105.0

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.54	0.53	0.05	0.04	0.15	0.14	0.08	0.06

The Dawn #1 gas field crosses Provincial Highway #21 and extends into Concessions 7, 8, 9, 10 and 11, Lots 23, 24, 25, of Dawn Township. The field is crossed by 5 Concession Roads west of Long Creek. The productive horizons along the Dawn Fault lie about 480 m below surface.

This area was sampled quite extensively during the 1991 programme (tilsey et al 1993). Additional soil gas stations were located to provide fill-in data along the north-trending township roads, and soil samples were taken adjacent to 1992 soil gas locations and at the points where previous radon determinations were made.

The soils of the area are moderately well drained, although wet to saturated during this survey. Soil gas radon concentrations indicated by the work reported herein are significantly lower than those measured in 1991. In general the highest values are found near the margins of the known oil and gas

pools, or near the Dawn Fault.

Radon emanation potential results are high in this area but do not correlate well with the observed radon in soil gas results.

Figure DG-1
Dawn Gas Field: Comparison between Soil Gas and Emanation Potential Results

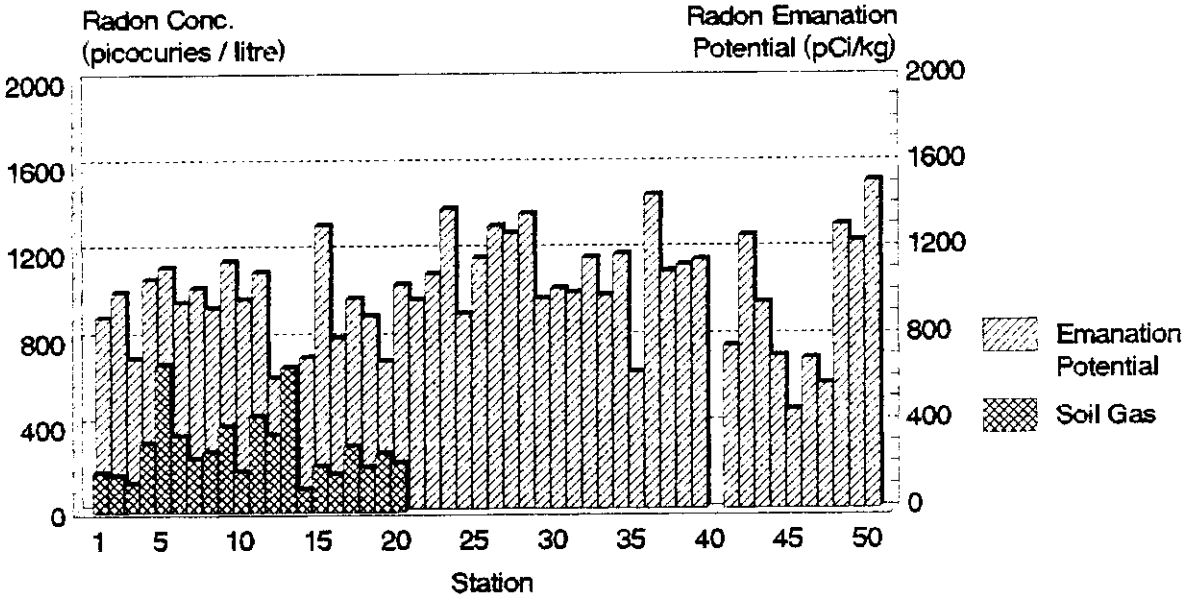
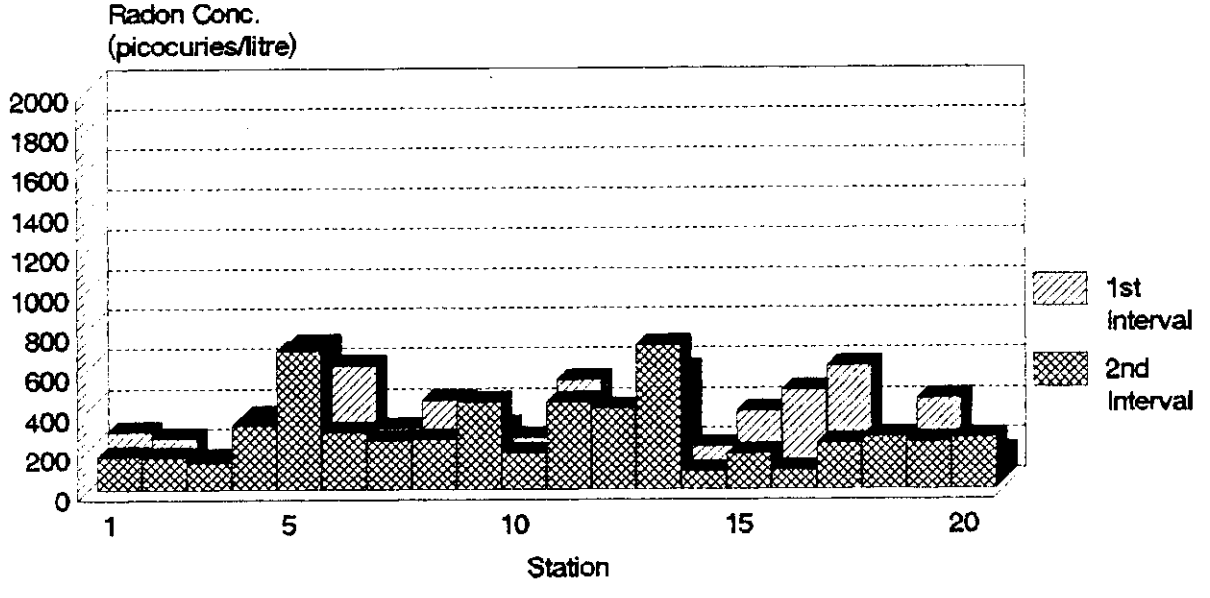


Figure DG-2
Dawn Gas Field: Soil Radon Gas Concentrations 1st and 2nd Intervals



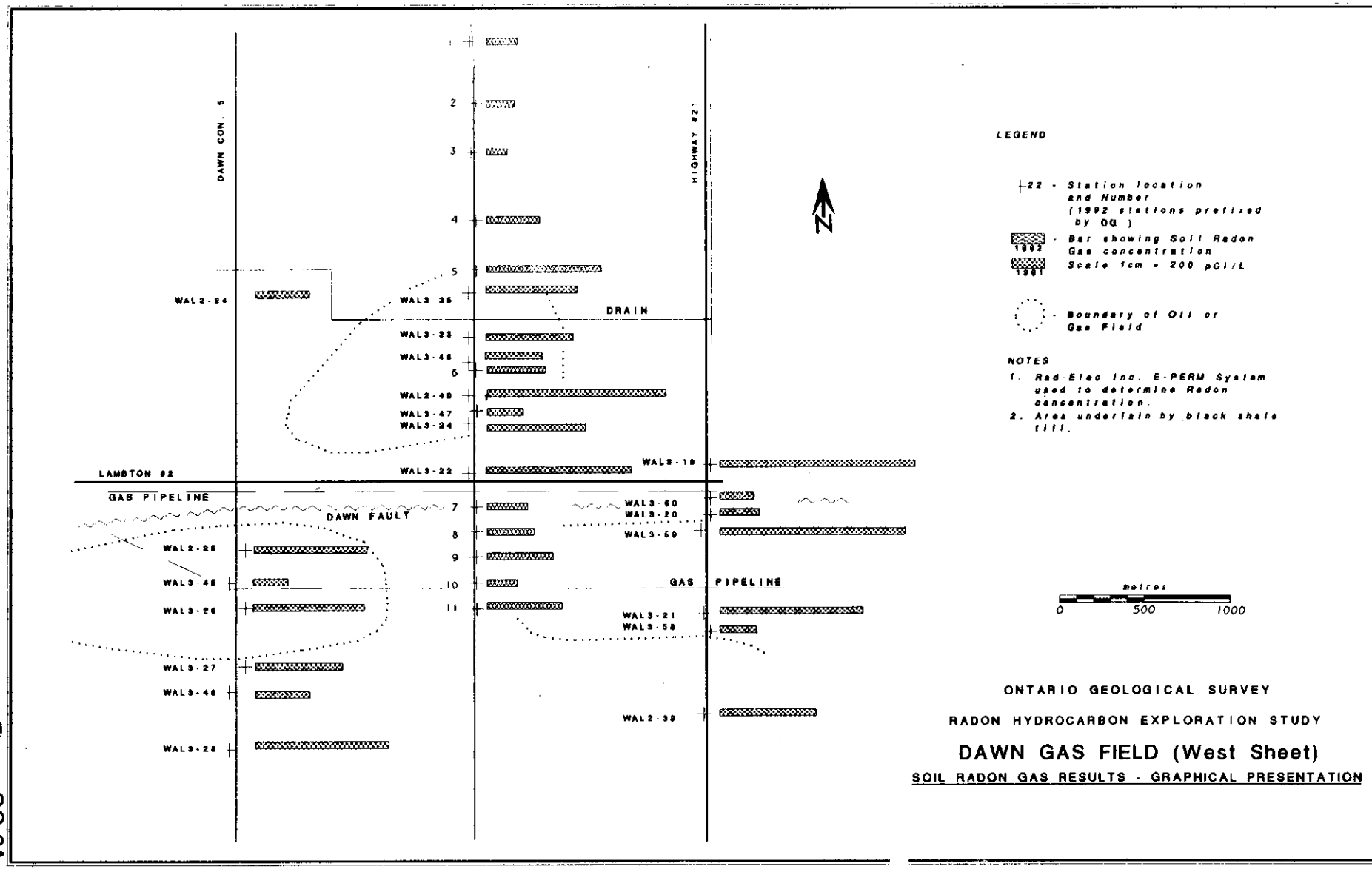

DAWN CON. 5
HIGHWAY #21
DRAIN
LAMBTON #2
GAS PIPELINE
DAWN FAULT
GAS PIPELINE
WAL2-24
WAL3-25
WAL3-23
WAL3-46
WAL2-40
WAL3-47
WAL3-24
WAL3-22
WAL3-18
WAL3-60
WAL3-20
WAL3-59
WAL2-25
WAL3-45
WAL3-26
WAL3-27
WAL3-48
WAL3-28
WAL3-21
WAL3-58
WAL2-39
1
2
3
4
5
6
7
8
9
10
11
N
LEGEND
22 - Station location and Number (1992 stations prefixed by DG)
1992
1991
Bar showing Soil Radon Gas concentration
Scale 1cm = 200 pCi/L
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (West Sheet)
SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure DG-3A

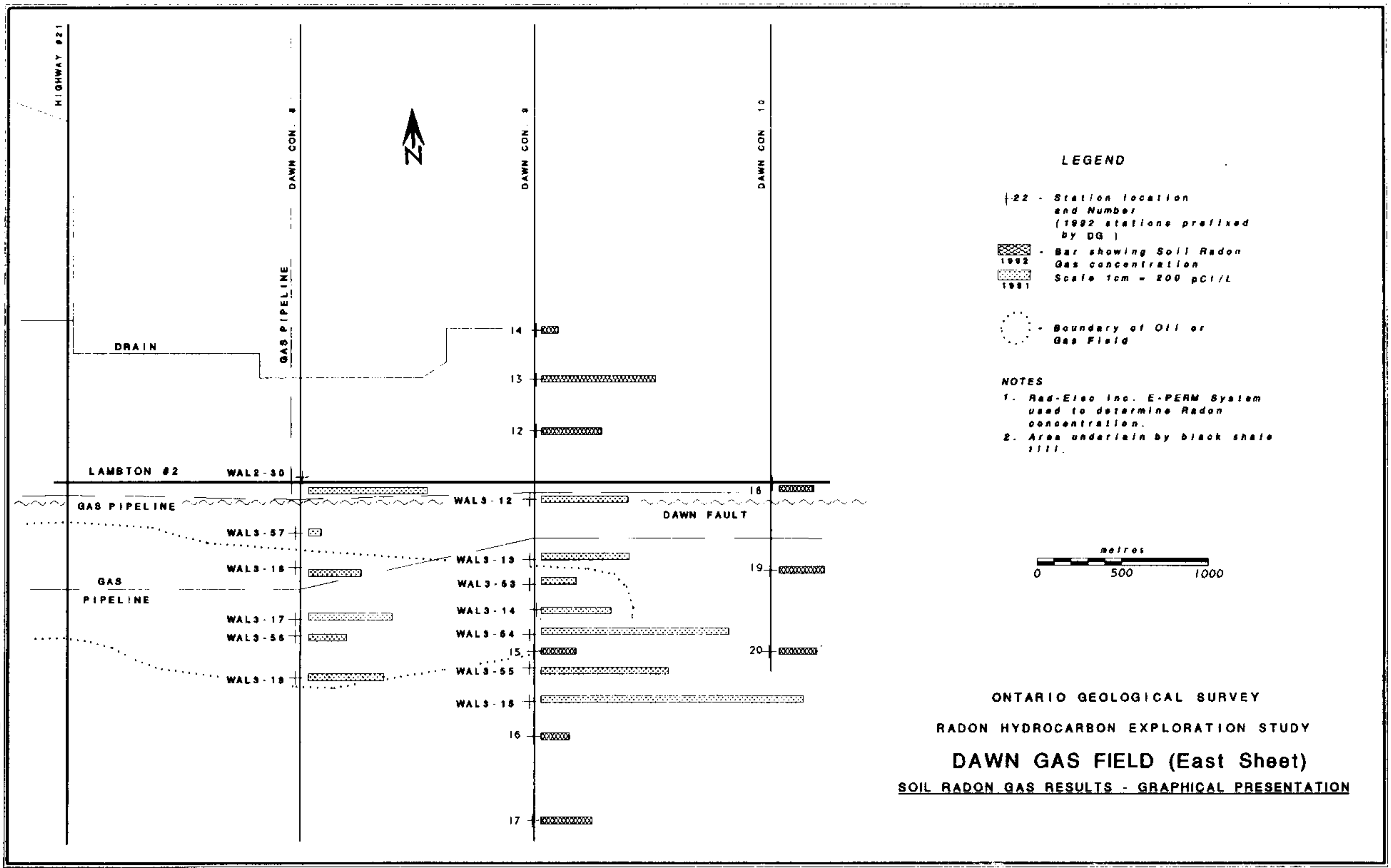

HIGHWAY #21
DAWN CON. 8
DAWN CON. 9
DAWN CON. 10
N
DRAIN
GAS PIPELINE
LAMBTON #2
WAL2-30
GAS PIPELINE
WAL3-12
DAWN FAULT
WAL3-57
WAL3-16
WAL3-13
GAS
PIPELINE
WAL3-53
WAL3-14
WAL3-17
WAL3-56
WAL3-54
WAL3-19
WAL3-55
WAL3-18
14
13
12
15
16
17
18
19
20
LEGEND
22 - Station location and Number (1992 stations prefixed by DG)
1992 - Bar showing Soil Radon Gas concentration
1991 Scale 1cm = 200 pCi/L
- Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale ////.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (East Sheet)
SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure DG-3B

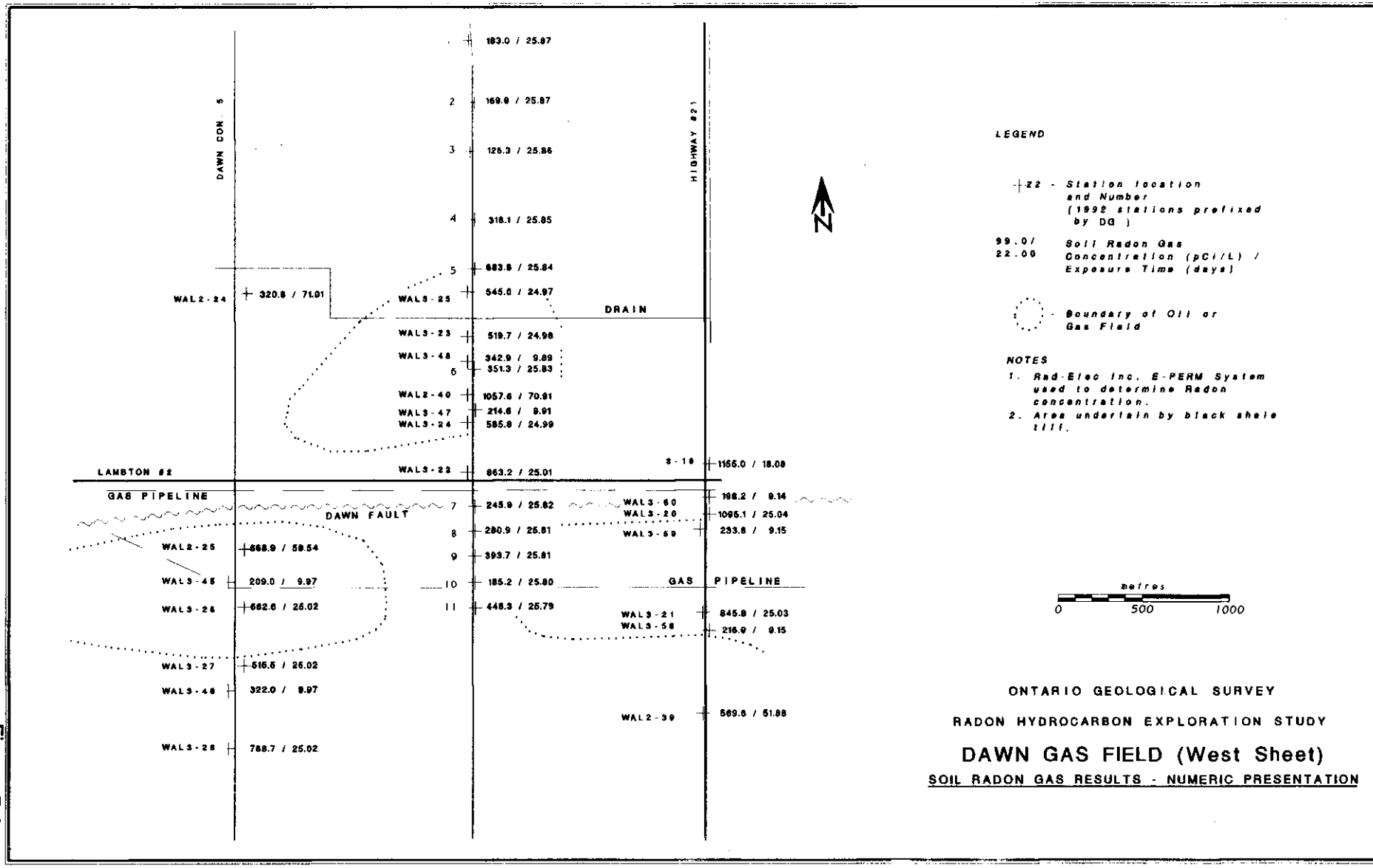

DAWN CON. 5
HIGHWAY #21
DRAIN
LAMBTON #2
GAS PIPELINE
DAWN FAULT
GAS PIPELINE
183.0 / 25.87
169.9 / 25.87
126.3 / 25.86
318.1 / 25.85
683.8 / 25.84
545.0 / 24.97
519.7 / 24.98
342.9 / 9.89
351.3 / 25.83
1057.6 / 70.91
214.6 / 9.91
585.9 / 24.99
863.2 / 25.01
245.9 / 25.82
280.9 / 25.81
393.7 / 25.81
185.2 / 25.80
448.3 / 25.79
320.8 / 71.01
668.9 / 59.54
209.0 / 9.97
662.6 / 25.02
516.5 / 25.02
322.0 / 9.97
788.7 / 25.02
1155.0 / 18.08
198.2 / 9.14
1095.1 / 25.04
233.6 / 9.15
845.8 / 25.03
216.9 / 9.15
569.6 / 51.88
WAL2-24
WAL3-25
WAL3-23
WAL3-48
WAL2-40
WAL3-47
WAL3-24
WAL3-22
WAL2-25
WAL3-45
WAL3-26
WAL3-27
WAL3-46
WAL3-28
3-18
WAL3-60
WAL3-20
WAL3-59
WAL3-21
WAL3-58
WAL2-39
N
LEGEND
Z2 - Station location and Number (1992 stations prefixed by DG)
99.0/ 22.00 Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (West Sheet)
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure DG-4A

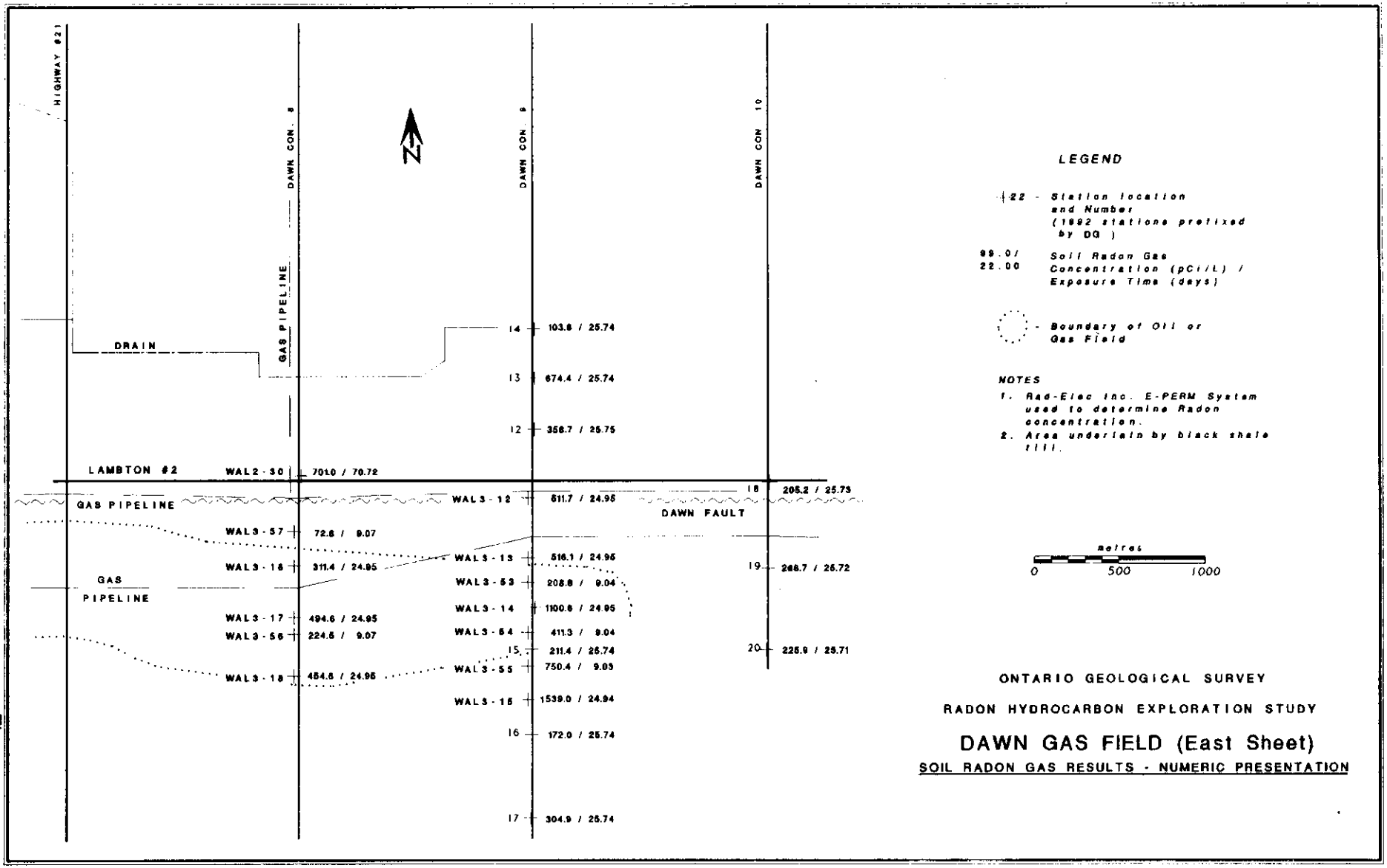

HIGHWAY #21
DAWN CON. 8
DAWN CON. 9
DAWN CON. 10
GAS PIPELINE
DRAIN
LAMBTON #2
GAS PIPELINE
GAS
PIPELINE
DAWN FAULT
WAL2-30 701.0 / 70.72
WAL3-57 72.6 / 9.07
WAL3-16 311.4 / 24.95
WAL3-17 494.6 / 24.95
WAL3-56 224.5 / 9.07
WAL3-18 484.6 / 24.95
WAL3-12 611.7 / 24.95
WAL3-13 516.1 / 24.95
WAL3-53 208.8 / 9.04
WAL3-14 1100.6 / 24.95
WAL3-54 411.3 / 9.04
WAL3-55 750.4 / 9.03
WAL3-15 1539.0 / 24.94
14 103.6 / 25.74
13 674.4 / 25.74
12 358.7 / 25.75
15 211.4 / 25.74
16 172.0 / 25.74
17 304.9 / 25.74
18 205.2 / 25.73
19 288.7 / 25.72
20 225.9 / 25.71
N
LEGEND
22 - Station location and Number (1992 stations prefixed by DG)
99.0/ 22.00 Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
Metres
0 500 1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (East Sheet)
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure DG-4B

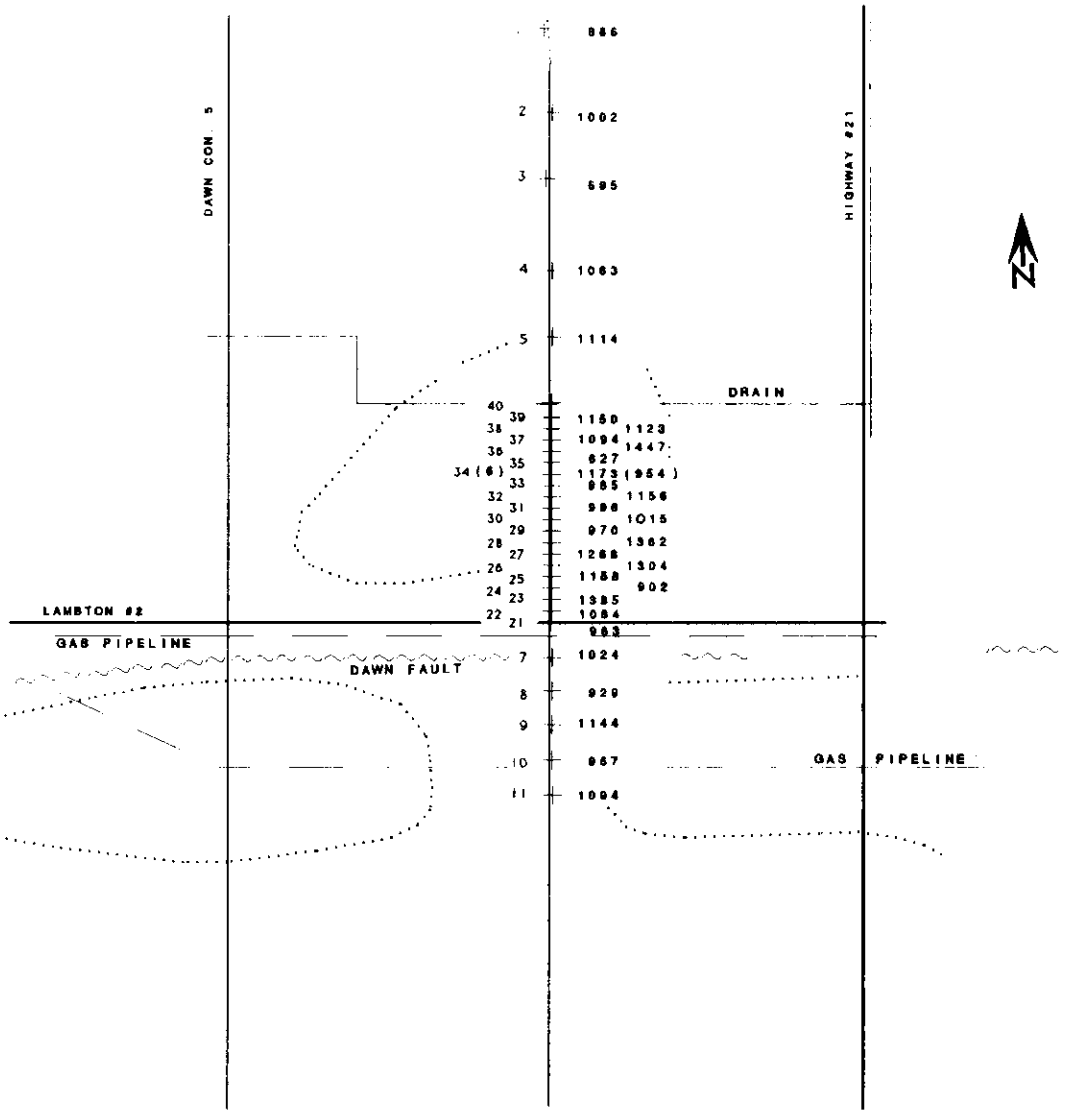

DAWN CON. 5
HIGHWAY #21
DRAIN
LAMBTON #2
GAS PIPELINE
DAWN FAULT
GAS PIPELINE
886
1002
595
1063
1114
1150
1094
827
1173
885
998
970
1288
1158
1385
1084
983
1024
929
1144
867
1094
1123
1447
(954)
1156
1015
1362
1304
902
LEGEND
22 - Station location and Number (1982 stations prefixed by DG)
545 Radon Emanation Potential (pCi/kg)
- Boundary of Oil or Gas Field
NOTES
1. Red-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (West Sheet)
RADON EMANATION POTENTIAL RESULTS

Figure DG-5A

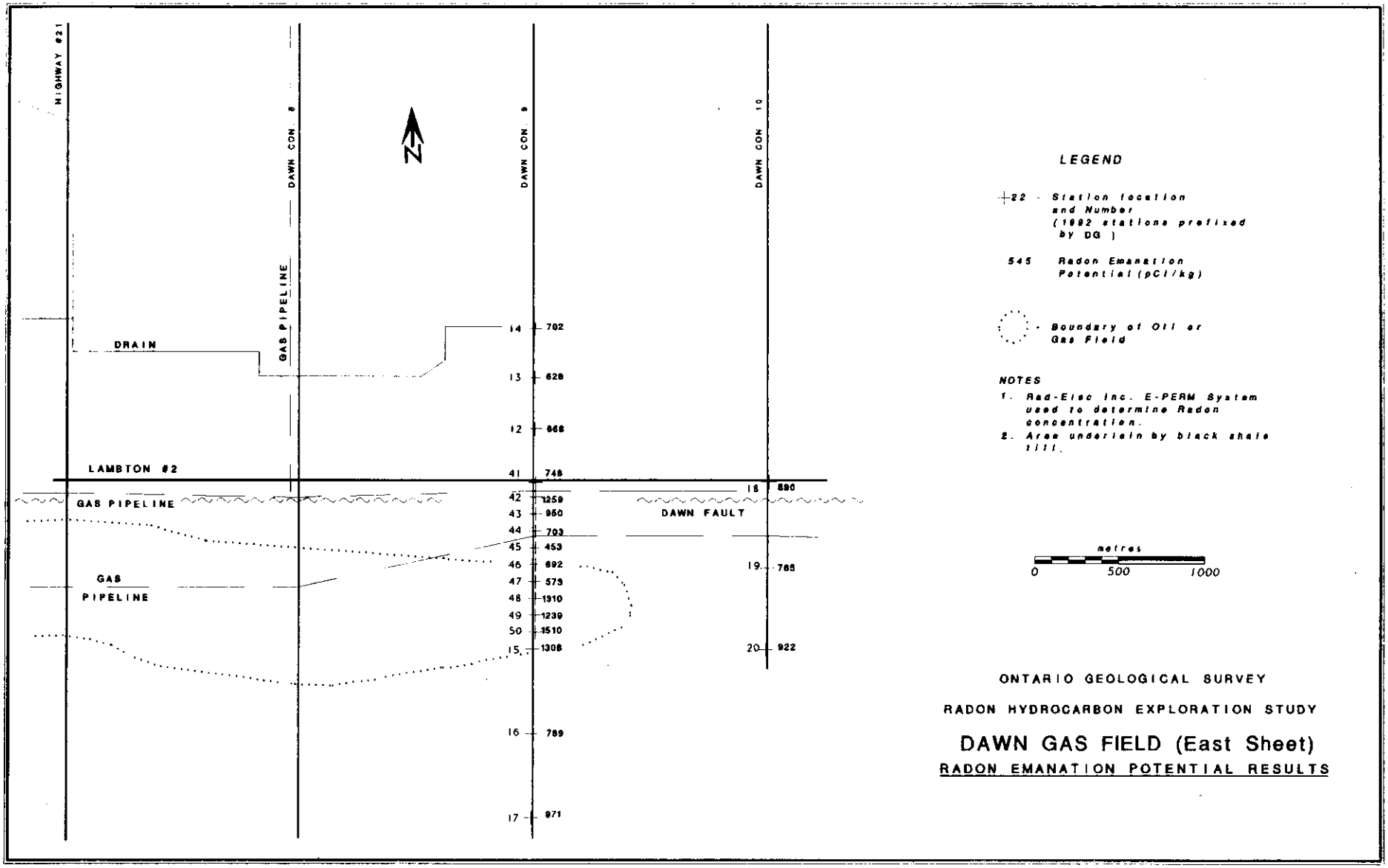
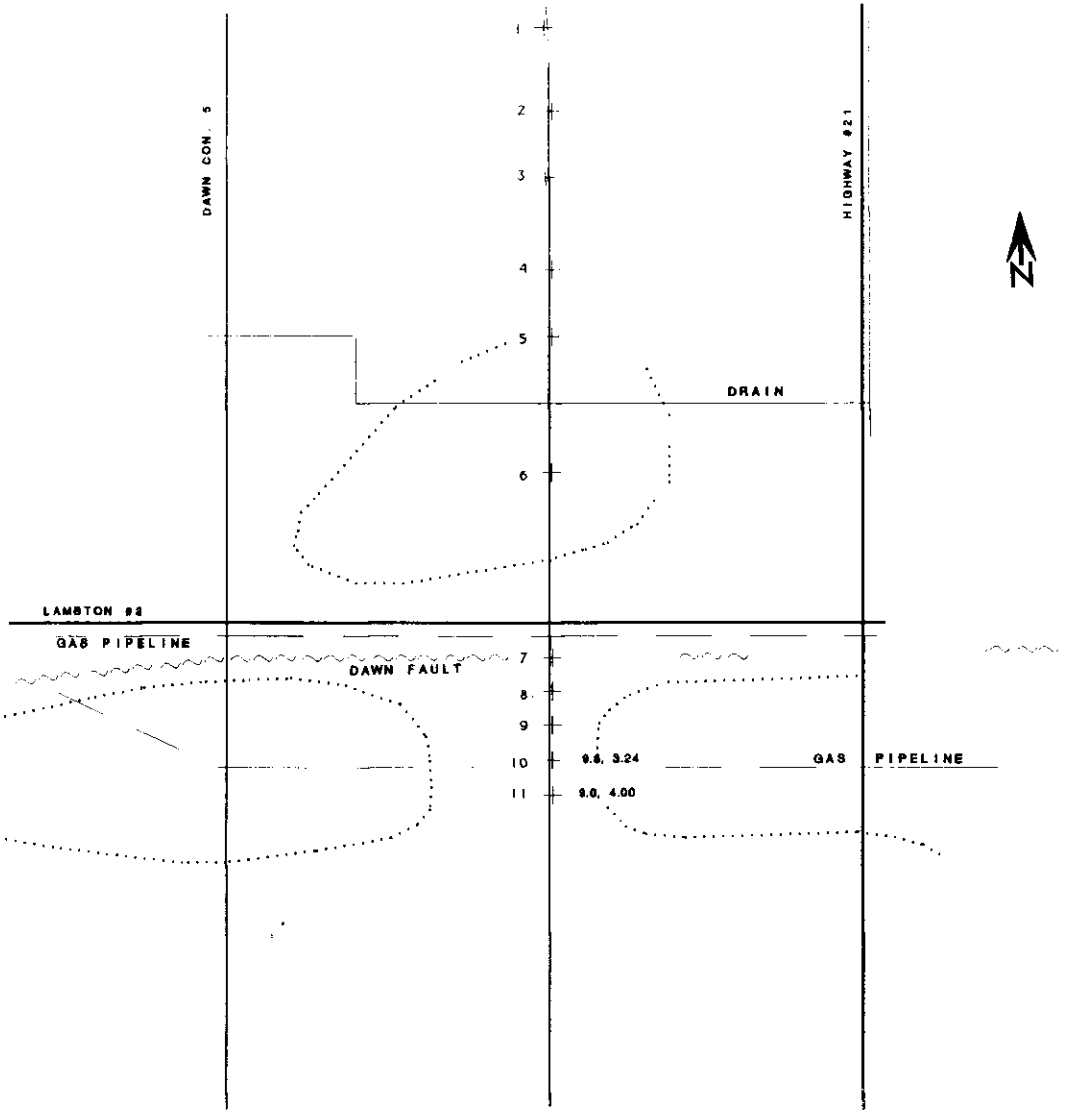

HIGHWAY #21
DAWN CON. 8
GAS PIPELINE
DAWN CON. 9
DAWN CON. 10
N
DRAIN
LAMBTON #2
GAS PIPELINE
GAS
PIPELINE
DAWN FAULT
14 702
13 628
12 668
41 748
42 1259
43 950
44 703
45 453
46 692
47 573
48 1310
49 1239
50 1510
15 1308
16 789
17 971
18 590
19 765
20 922
LEGEND
22 Station location and Number (1992 stations prefixed by DG)
545 Radon Emanation Potential (pCi/kg)
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
metres
0 500 1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (East Sheet)
RADON EMANATION POTENTIAL RESULTS

Figure DG-5B



LEGEND

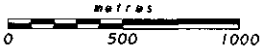
+22 - Station location and Number (1992 stations prefixed by DG)

1.8, 3.66 Uranium (ppm), Radium (pCi/g)

Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.



ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

DAWN GAS FIELD (West Sheet)

URANIUM AND RADIUM GEOCHEMICAL RESULTS

Figure DG-6A

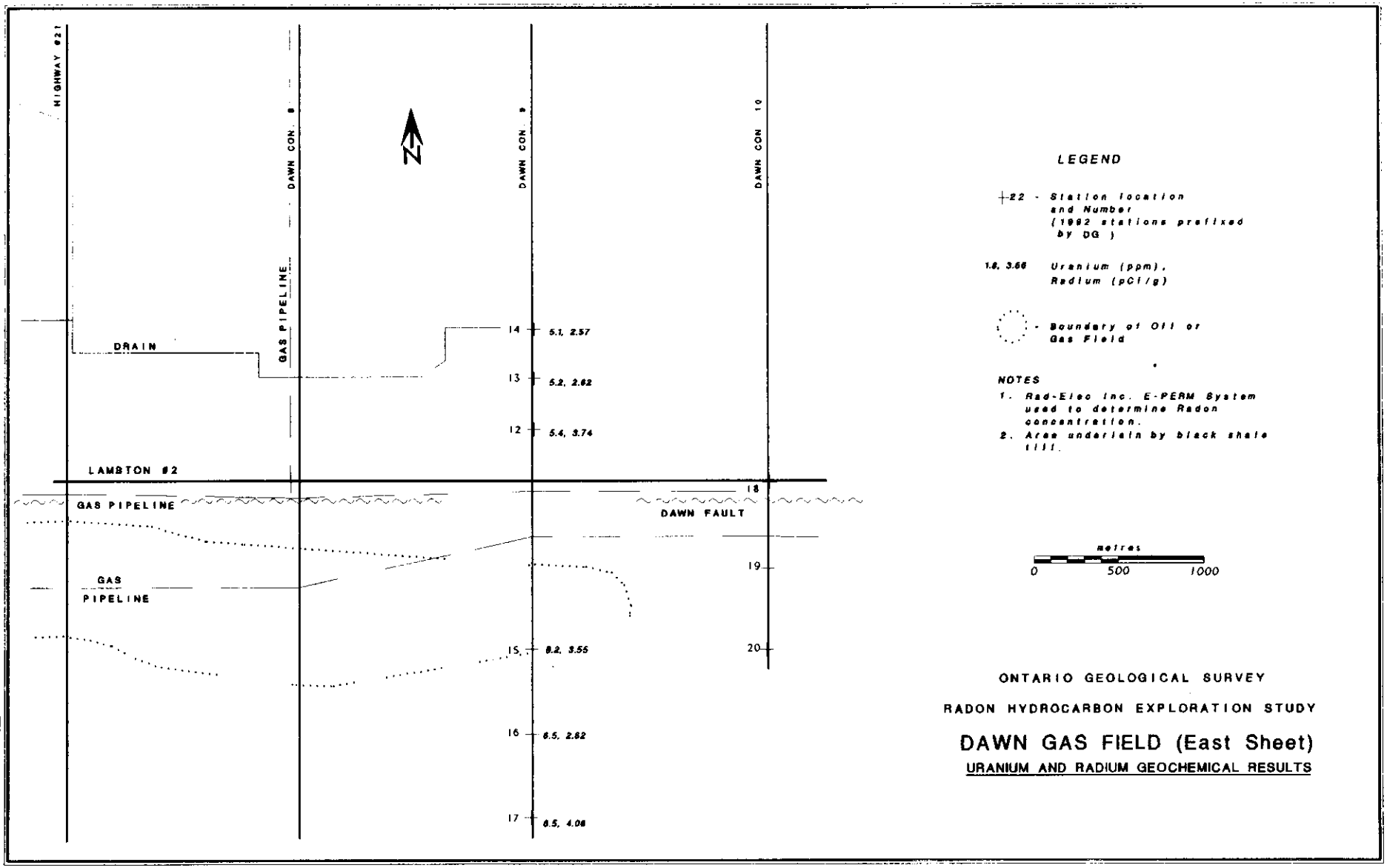

HIGHWAY #21
DAWN CON. 8
DAWN CON. 9
DAWN CON 10
GAS PIPELINE
DRAIN
LAMBTON #2
GAS PIPELINE
GAS
PIPELINE
DAWN FAULT
14 5.1, 2.57
13 5.2, 2.62
12 5.4, 3.74
18
19
15 8.2, 3.55
20
16 6.5, 2.62
17 6.5, 4.06
LEGEND
22 - Station location and Number (1982 stations prefixed by DG)
1.8, 3.66 Uranium (ppm), Radium (pCi/g)
- Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DAWN GAS FIELD (East Sheet)
URANIUM AND RADIUM GEOCHEMICAL RESULTS

Figure DG-6B

DOVER (Ordovician, oil & gas)
Figures DO-1, DO-2, DO-3, DO-4, DO-5, DO-6.

Location	U.T.M. 4690000N, 387000E 17T LS Dover Township Con 5 and 6
Surficial Geology	Silt and clay veneer overlying black shale till
Drift Thickness	25 m to 30 m
Underlying Bedrock	Kettle Point Fm. shales, Hamilton Group
Hydrocarbon Bearing Unit	Trenton Formation carbonates
Depth Below Surface	880 m
Type of Reservoir	Structural, Faulted block

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
153.9	418.7	33.3	82.0	336.9	624	148	107.3

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
186.8	479.9	49.4	99.3	135.9	436.9	24.0	85.7

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.61	0.52	0.07	.06	-0.08	-.0.07	0.02	0.02

The Dover Field lies about 7 km west of Chatham on an east-trending fault that crosses the boundary between East and West Dover townships about 1 km north of the Thames River.

The main fault and 2 mapped subsidiary faults control the oil and gas traps. The main fault has a throw of about 10 m, west side down. The secondary breaks appear to have displacements of 5 m or less. The productive structures are relatively small and pod-like. Most are less than 500 m wide and are bounded by either the main fault alone, or by the main fault and one of the secondary faults.

The productive levels lie between about 700 and 800 m below sea level, and about 890 and 940 m below surface.

The sampling profiles are laid out along the township road between Concessions III and IV, East Dover. A second sampling profile was completed along the concession road between Concessions II and III, West Dover. Both profiles cross both the main fault and one of the secondary faults. A third sampling line along the common boundary of Concessions I & II, West Dover, beginning at the East Dover/West Dover line road and extending west for ~500 m crosses one of the subsidiary faults and a southeasterly extending lobe of the field.

The area is quite well drained although the soils were wet to saturated during this survey. The highest radon in soil gas concentrations were located near the field boundaries or in close proximity to the fault traces. Contrast was 2 to 3 times background. Both soil gas values and radon emanation potential results are lower than those from other fields in the Wallaceburg area.

Figure DO–1
Dover Gas Field: Comparison between Soil Gas and Emanation Potential Results

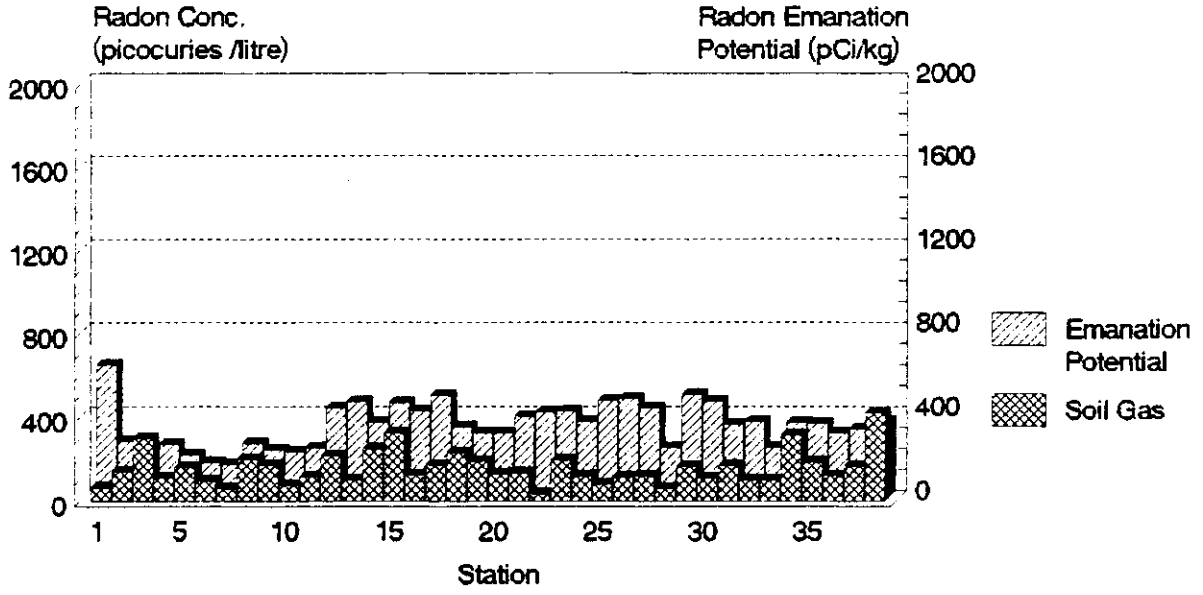
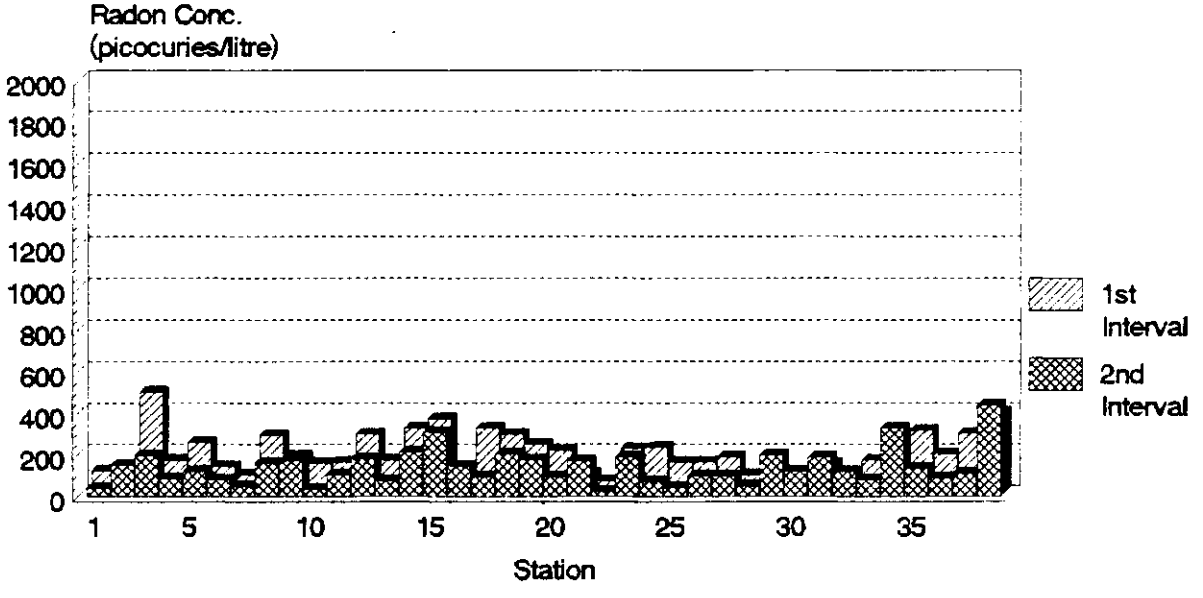


Figure DO–2
Dover Gas Field: Soil Radon Gas Concentrations 1st and 2nd Intervals



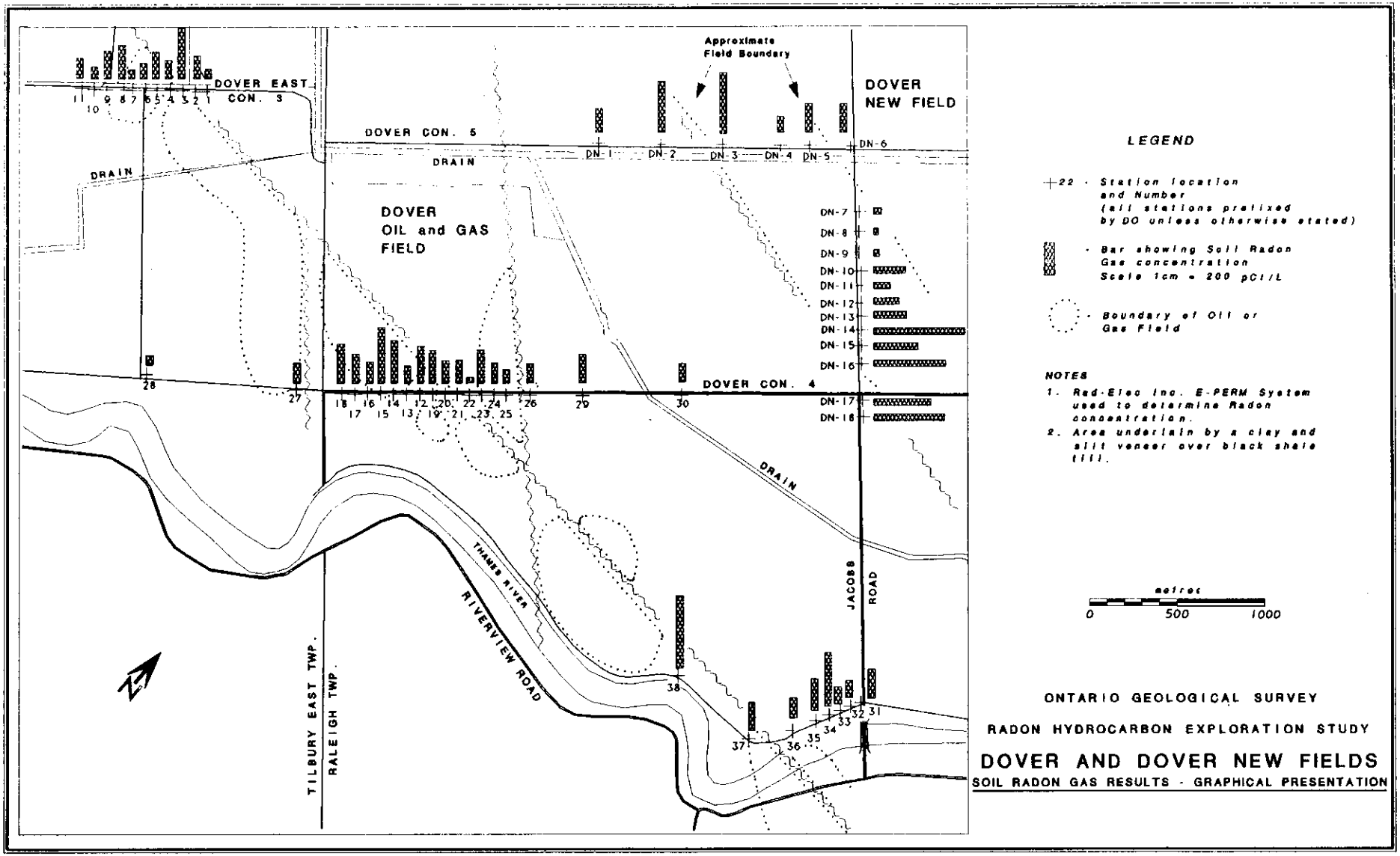

DOVER EAST
CON. 3
DOVER CON. 5
DRAIN
DOVER
OIL and GAS
FIELD
Approximate
Field Boundary
DOVER
NEW FIELD
DN-1
DN-2
DN-3
DN-4
DN-5
DN-6
DN-7
DN-8
DN-9
DN-10
DN-11
DN-12
DN-13
DN-14
DN-15
DN-16
DN-17
DN-18
DOVER CON. 4
DRAIN
THAMES RIVER
RIVERVIEW ROAD
JACOBS ROAD
TILBURY EAST TWP.
RALEIGH TWP.
N
LEGEND
22 · Station location and Number (all stations prefixed by DO unless otherwise stated)
· Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L
· Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DOVER AND DOVER NEW FIELDS
SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

FIGURE DO-3

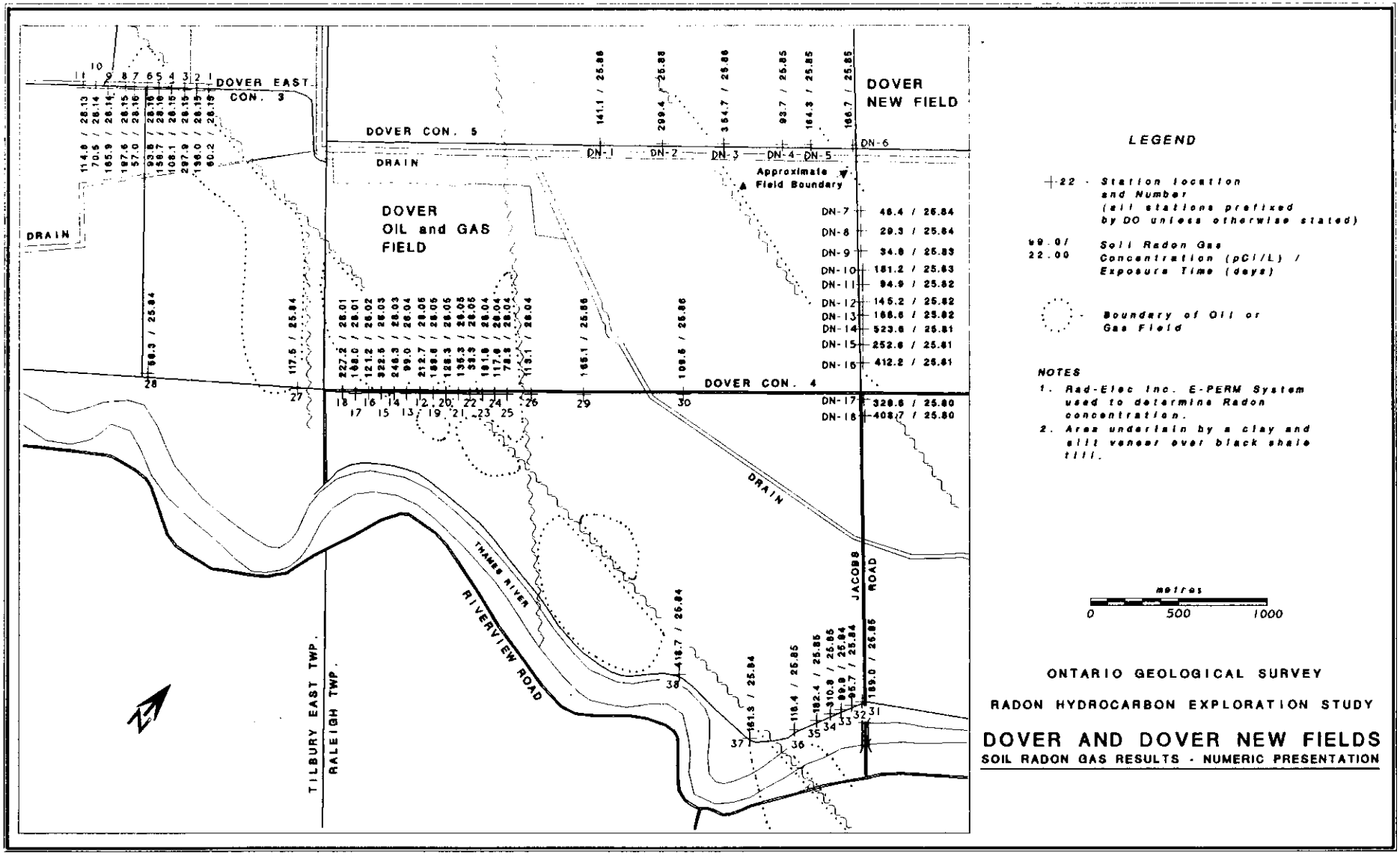
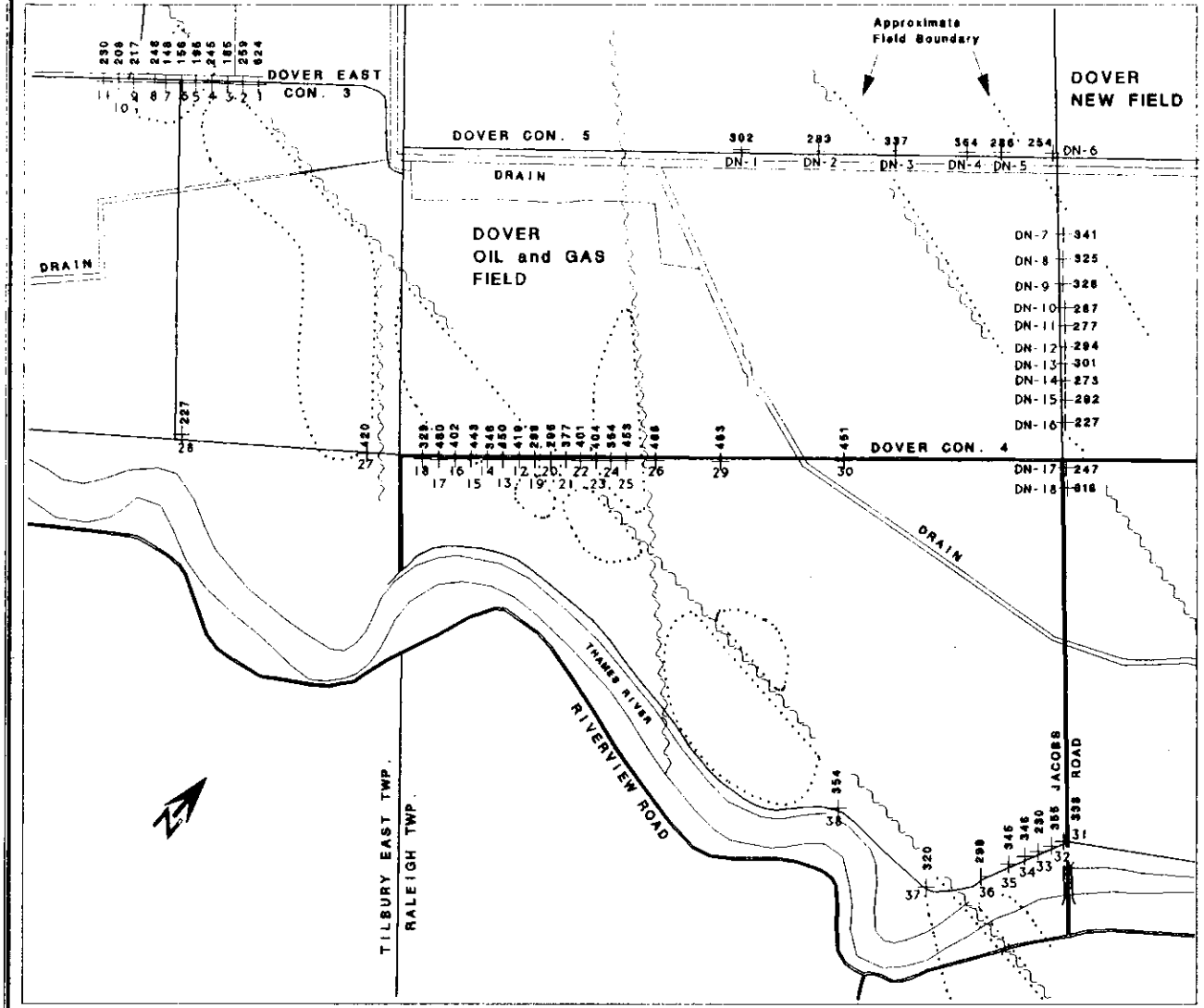

DOVER EAST CON. 3
DOVER CON. 5
DOVER CON. 4
DOVER NEW FIELD
DOVER OIL and GAS FIELD
DRAIN
DRAIN
DRAIN
Approximate Field Boundary
DN-1
DN-2
DN-3
DN-4
DN-5
DN-6
DN-7 46.4 / 25.84
DN-8 29.3 / 25.84
DN-9 34.8 / 25.83
DN-10 181.2 / 25.83
DN-11 94.9 / 25.82
DN-12 145.2 / 25.82
DN-13 166.6 / 25.82
DN-14 523.6 / 25.81
DN-15 252.6 / 25.81
DN-16 412.2 / 25.81
DN-17 328.6 / 25.80
DN-18 408.7 / 25.80
THAMES RIVER
RIVERVIEW ROAD
JACOBS ROAD
TILBURY EAST TWP.
RALEIGH TWP.
N
LEGEND
22 - Station location and Number (all stations prefixed by DO unless otherwise stated)
99.0/ 22.00 Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DOVER AND DOVER NEW FIELDS
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure DO-4



LEGEND

+22 - Station location and Number (all stations prefixed by DO unless otherwise stated)

545 Radon Emenation Potential (pCi/kg)

- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.

metres
0 500 1000

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

DOVER AND DOVER NEW FIELDS
RADON EMANATION POTENTIAL RESULTS

FIGURE DO-5

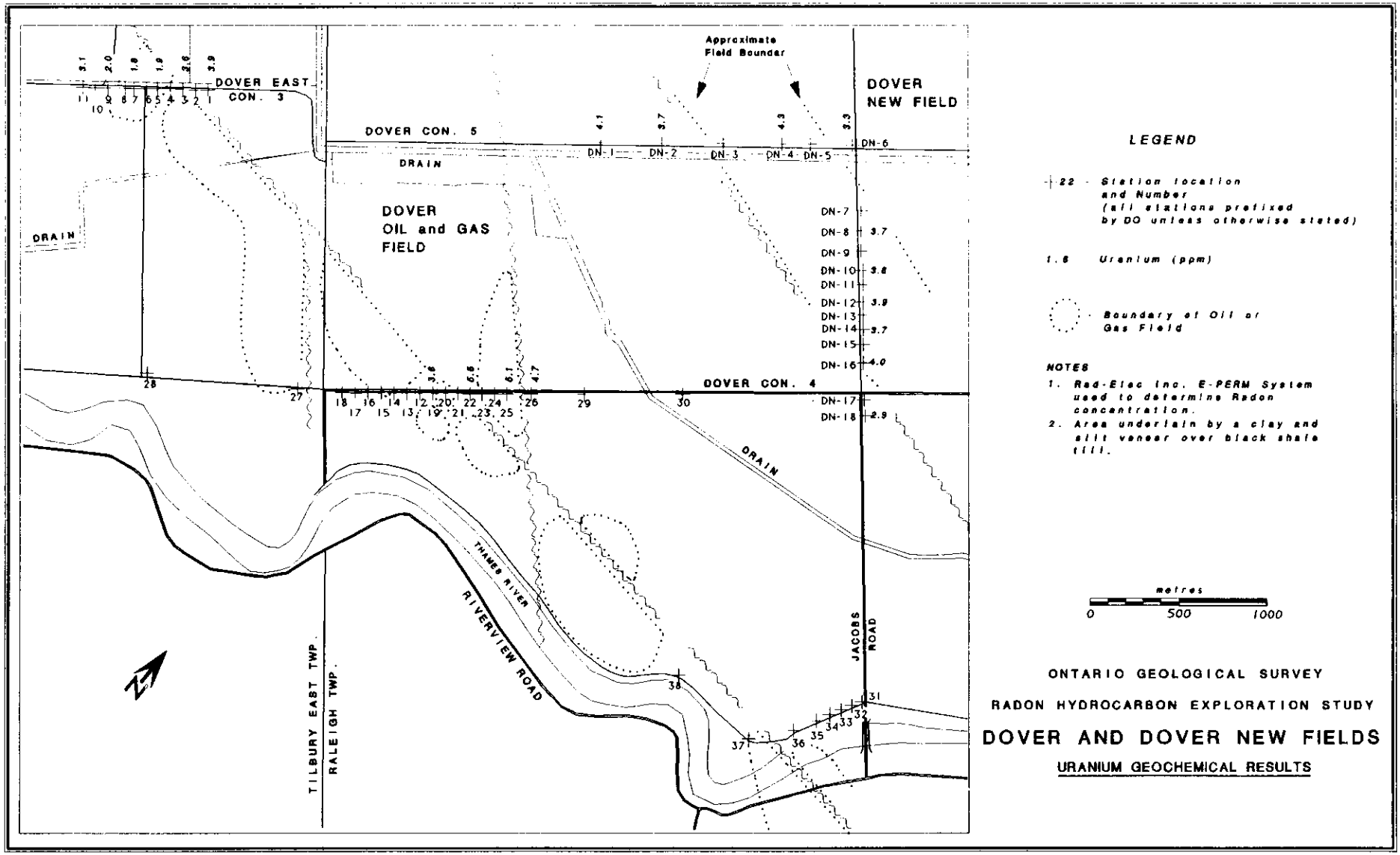

DOVER EAST
CON. 3
DOVER CON. 5
DOVER CON. 4
DOVER
NEW FIELD
DOVER
OIL and GAS
FIELD
Approximate
Field Boundar
DRAIN
DRAIN
DRAIN
DN-1
DN-2
DN-3
DN-4
DN-5
DN-6
DN-7
DN-8
DN-9
DN-10
DN-11
DN-12
DN-13
DN-14
DN-15
DN-16
DN-17
DN-18
THAMES RIVER
RIVERVIEW ROAD
JACOBS ROAD
TILBURY EAST TWP.
RALEIGH TWP.
LEGEND
22 - Station location and Number (all stations prefixed by DO unless otherwise stated)
1.6 Uranium (ppm)
Boundary of Oil or Gas Field
NOTES
1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.
metres
0
500
1000
ONTARIO GEOLOGICAL SURVEY
RADON HYDROCARBON EXPLORATION STUDY
DOVER AND DOVER NEW FIELDS
URANIUM GEOCHEMICAL RESULTS

FIGURE DO-9

DOVER NEW FIELD Pool 7 - 5 - VE (Ordovician, oil & gas)
Figures DN-1, DN-2.

Location	U.T.M. 4692000N, 389000E 17T LS Dover Township Con 5 and 6
Surficial Geology	Silt and clay veneer overlying black shale till
Drift Thickness	20 m
Underlying Bedrock	Kettle Point Formation shales
Hydrocarbon Bearing Unit	Trenton Carbonates
Depth Below Surface	~880 m
Type of Reservoir	Structural, Faulted Block

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
214.9	523.6	29.3	144.2	296.4	364.0	227.0	35.1

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
226.5	881.5	25.4	210.7	210.0	451.6	23.6	128.8

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.76	0.46	-0.43	-1.60	-0.42	-2.57	-0.46	-1.89

This study area lies east of the main Dover field. Comments as given for the Dover site apply as well in this area. There is not much information in the current literature on this field, but the producing wells are aligned so as to suggest fault control similar to that in the more explored areas to the west.

Highest radon in soil gas values are seen near the western boundary of the field, apparently along the trace of the controlling fault. Soil gas radon values to 523.6pCi/L were measured over this structure. Values decreased to background to the east. Soil gas radon contrast was five to ten times the lowest values obtained.

Apparent radium values range from 227 pCi/kg to 364 pCi/kg, the highest being 60% larger than

the lowest. This is not great contrast, and interpretation of these data is, consequently, difficult.

Figure DN-1
Dover New Field: Comparison between Soil Gas and Emanation Potential Results

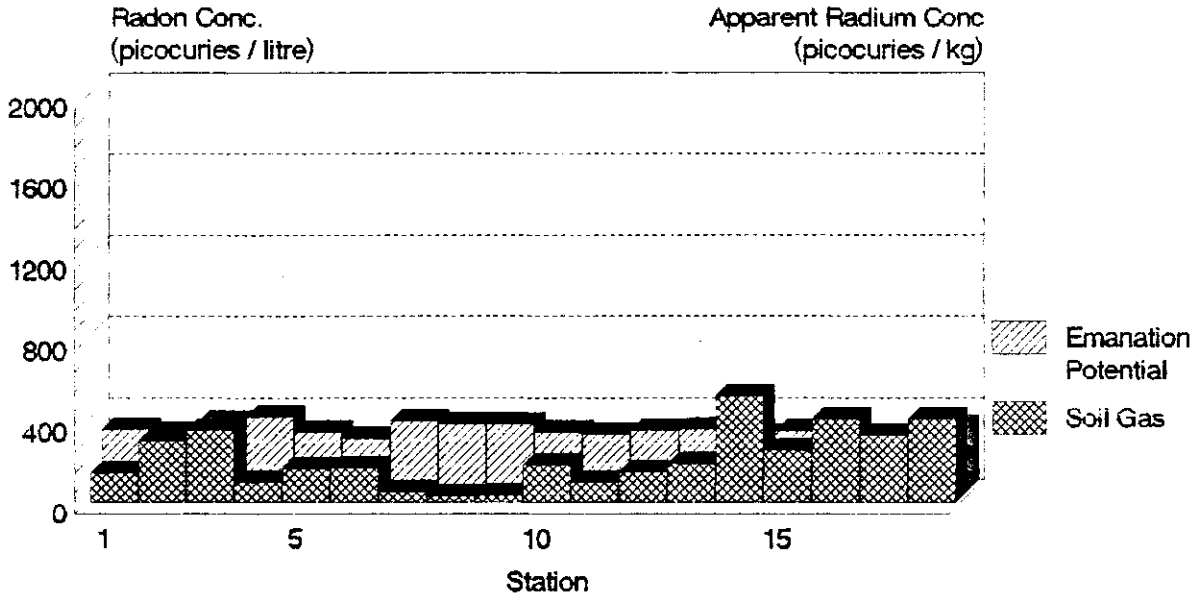
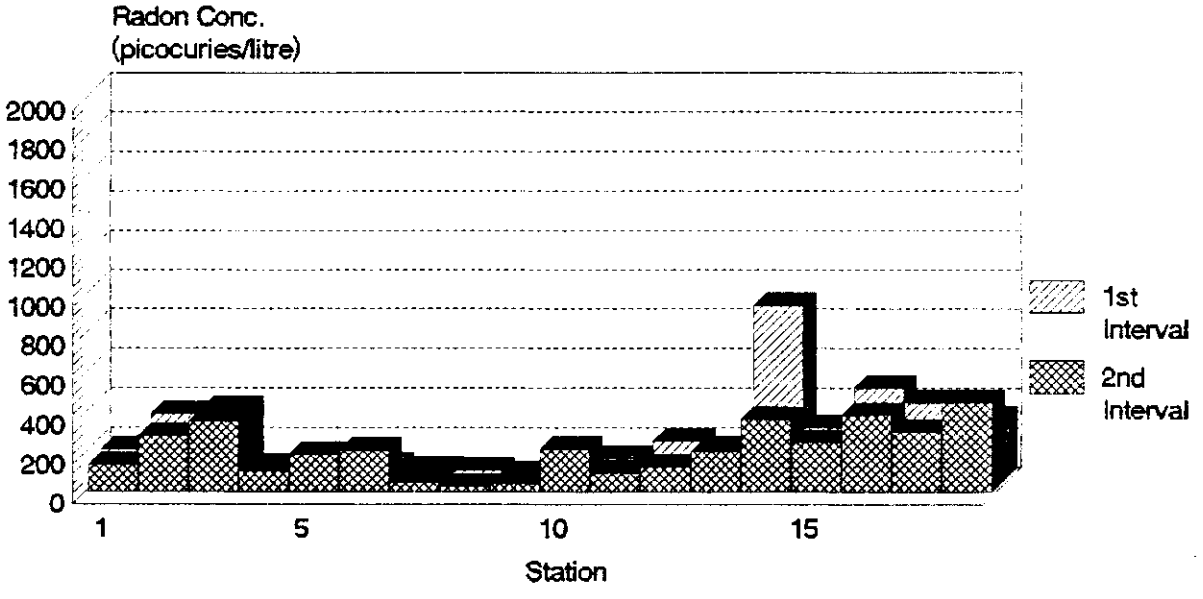


Figure DN-2
Dover New Field: Soil Radon Gas Concentrations 1st and 2nd Intervals



FLORENCE-OAKDALE FIELD (Devonian)

Figures FL-1, FL-2, FL-3, FL-4, FL-5, FL-6.

Location	U.T.M. 4725000N, 414700E 17T MT
Surficial Geology	Clay & silt veneer on Black shale till
Drift Thickness	~15 m
Underlying Bedrock	Kettle Point Formation shales
Hydrocarbon Bearing Unit	Dundee Formation limestone, Columbus Fm. sandstone
Depth Below Surface	104 m
Type of Reservoir	Structural, dome

STATISTICAL SUMMARY

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
188.1	653.5	11.3	189.7	171.0	622.9	32.4	165.3

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
174.9	588.9	34.9	146.6	814.3	1223.0	213.0	350.7

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.31	0.27	0.21	0.09	0.46	0.28	0.32	0.14

The Florence-Oakdale field lies in the southeastern quarter of Dawn Township in Concessions XII and XII, Lots 18, 19, and 20, about 1 km west of the Sydenham River.

The productive horizons lie near to surface, between 70 and 110 m deep. The structure is a small dome about 2 km by 1.2 km, discovered in 1897, making it the third oldest of the fields in Lambton County.

Nine locations along Dawn township Road 12 that cuts the field were sampled during the previous reconnaissance programme (Tilsey et al. 1993). The north-trending profile was refined by 18 additional soil gas sample sites and 25 soil samples taken at 50 m intervals along Dawn Concession Road 12 southward from the intersection with Dawn Side Road #21.

Surface drainage is poor to fair. Soil gas radon results are highly variable (37.9 pCi/L to 588.9

pCi/L) with the highest results from the central part of the field and from near the mapped boundaries.

Radon emanation potentials are relatively high and show variations across the field that are reflected by the soil gas radon values. However, correlation coefficients are not good, perhaps the result of nearly saturated soils modifying the soil gas radon results.

Figure FL-1
Florence-Oakdale: Comparison between
Soil Gas and Emanation Potential Results

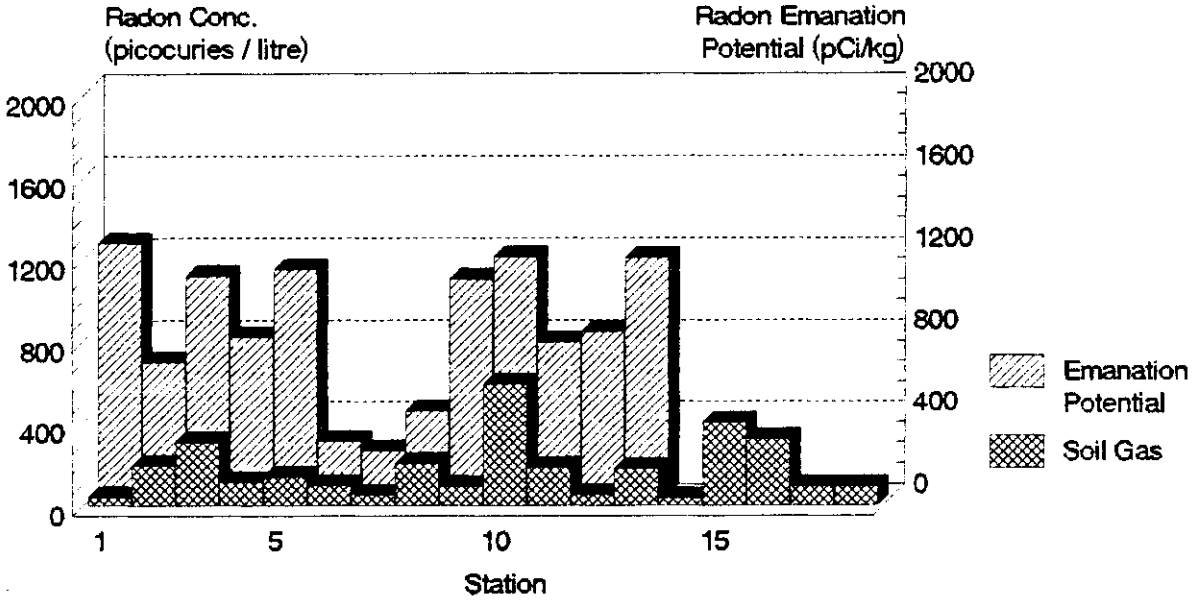
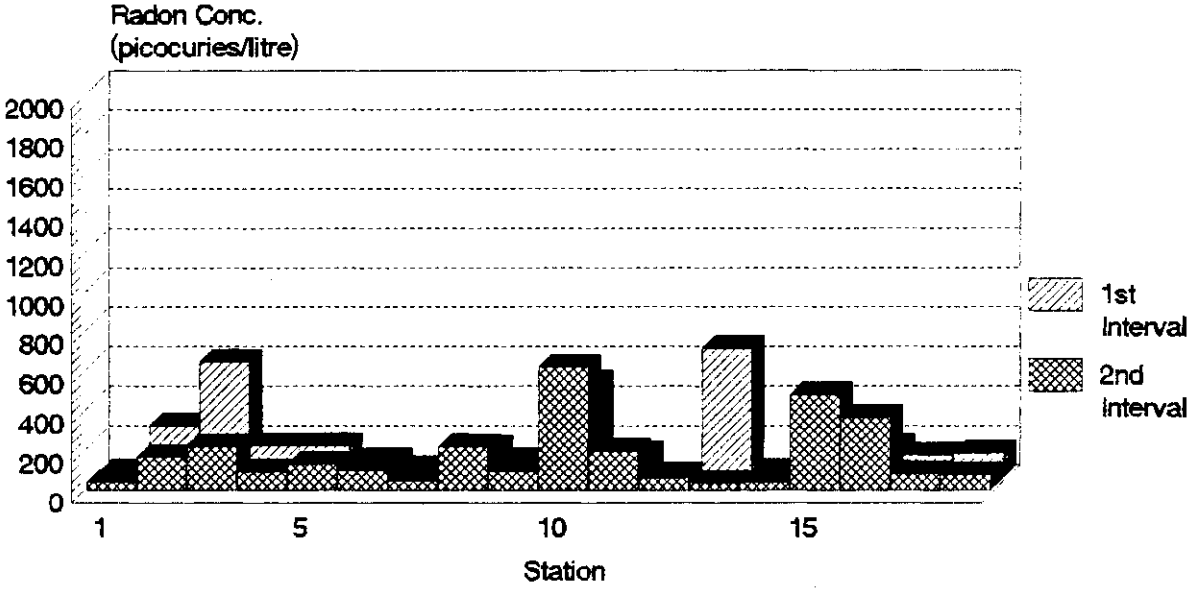
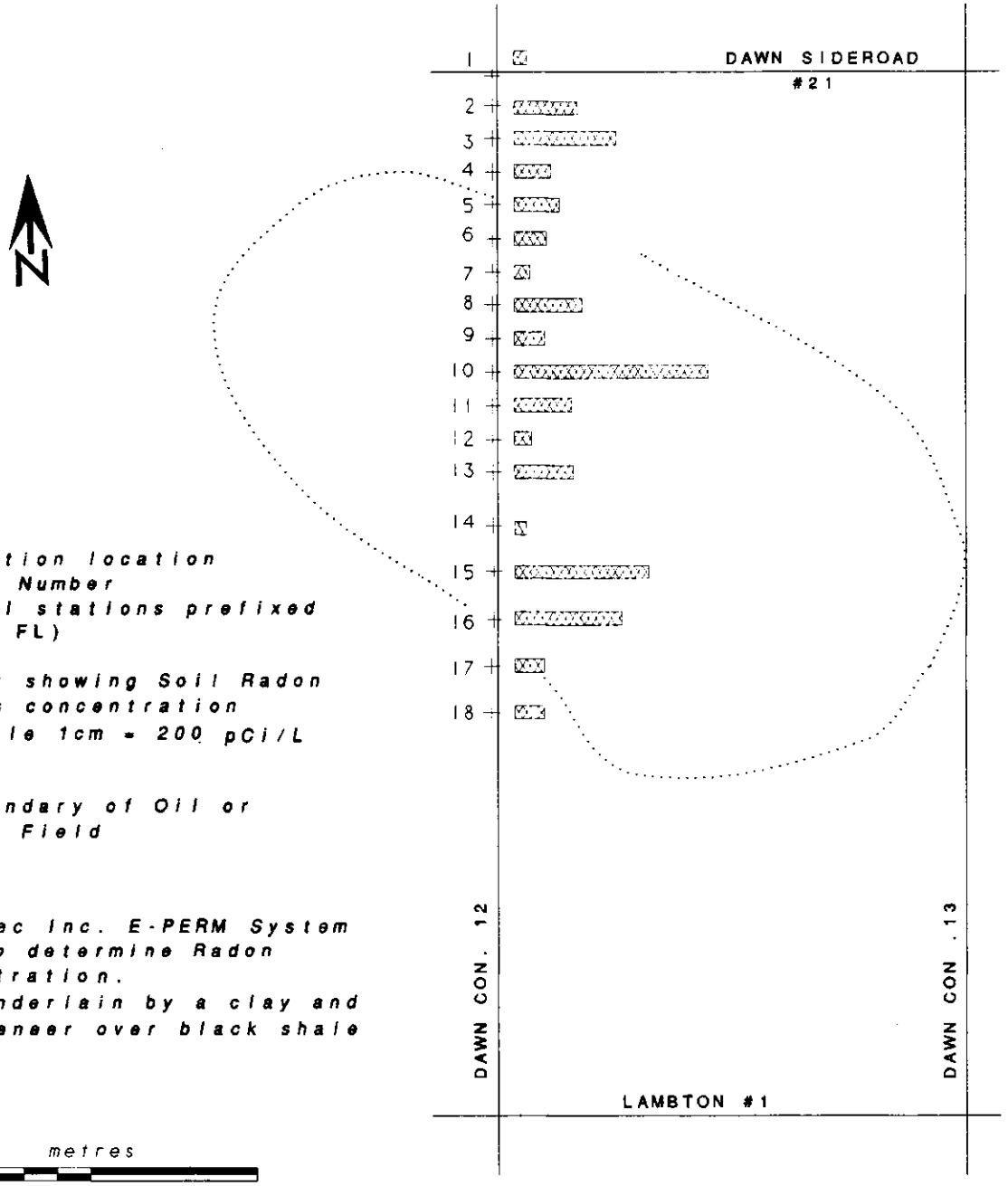


Figure FL-2
Florence-Oakdale: Soil Radon Gas
Concentrations 1st and 2nd Intervals





LEGEND

+22 - *Station location and Number (all stations prefixed by FL)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by a clay and silt veneer over black shale till.*

metres

0 500 1000

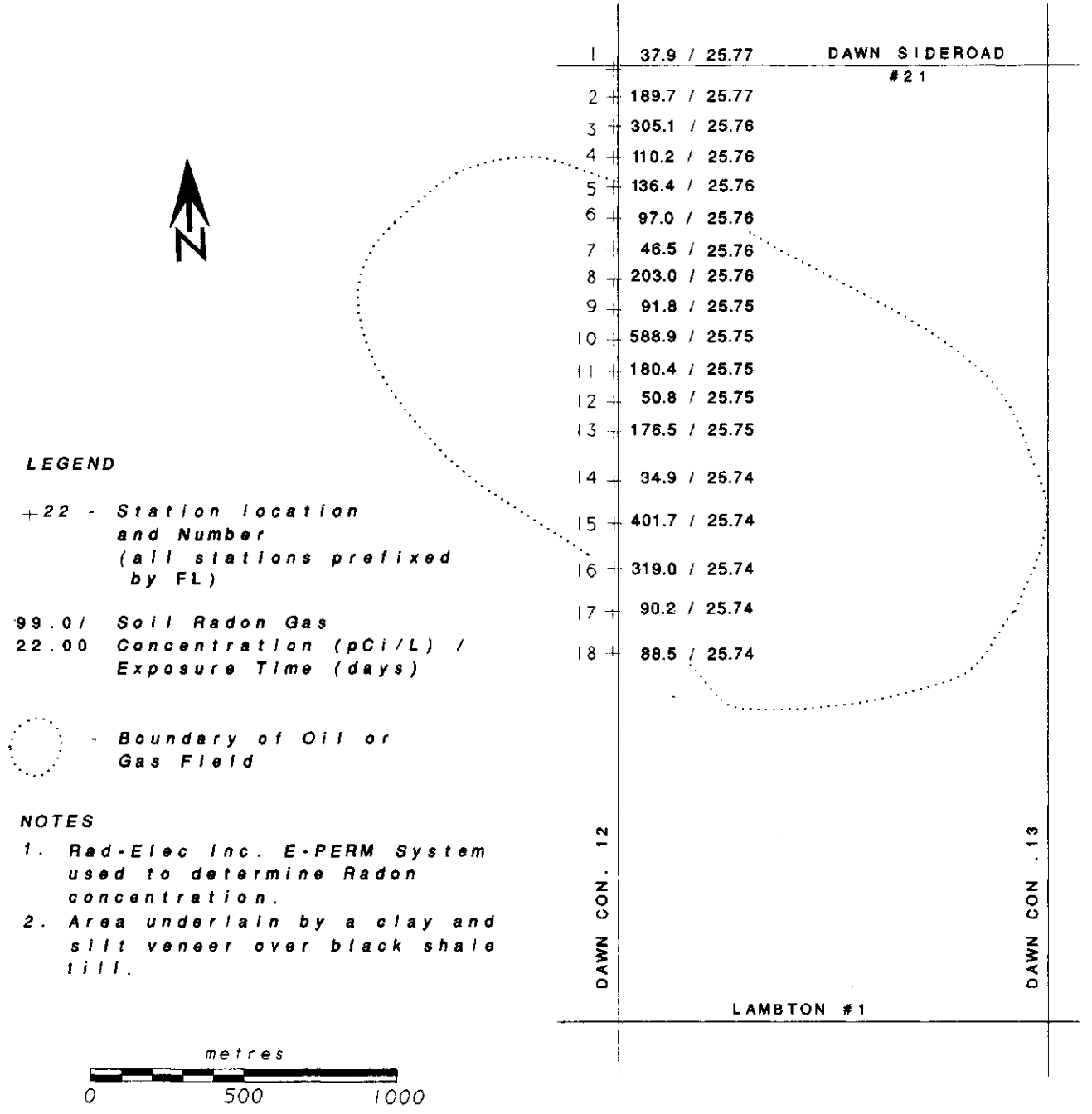
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

FLORENCE - OAKDALE OIL FIELD

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure FL-3



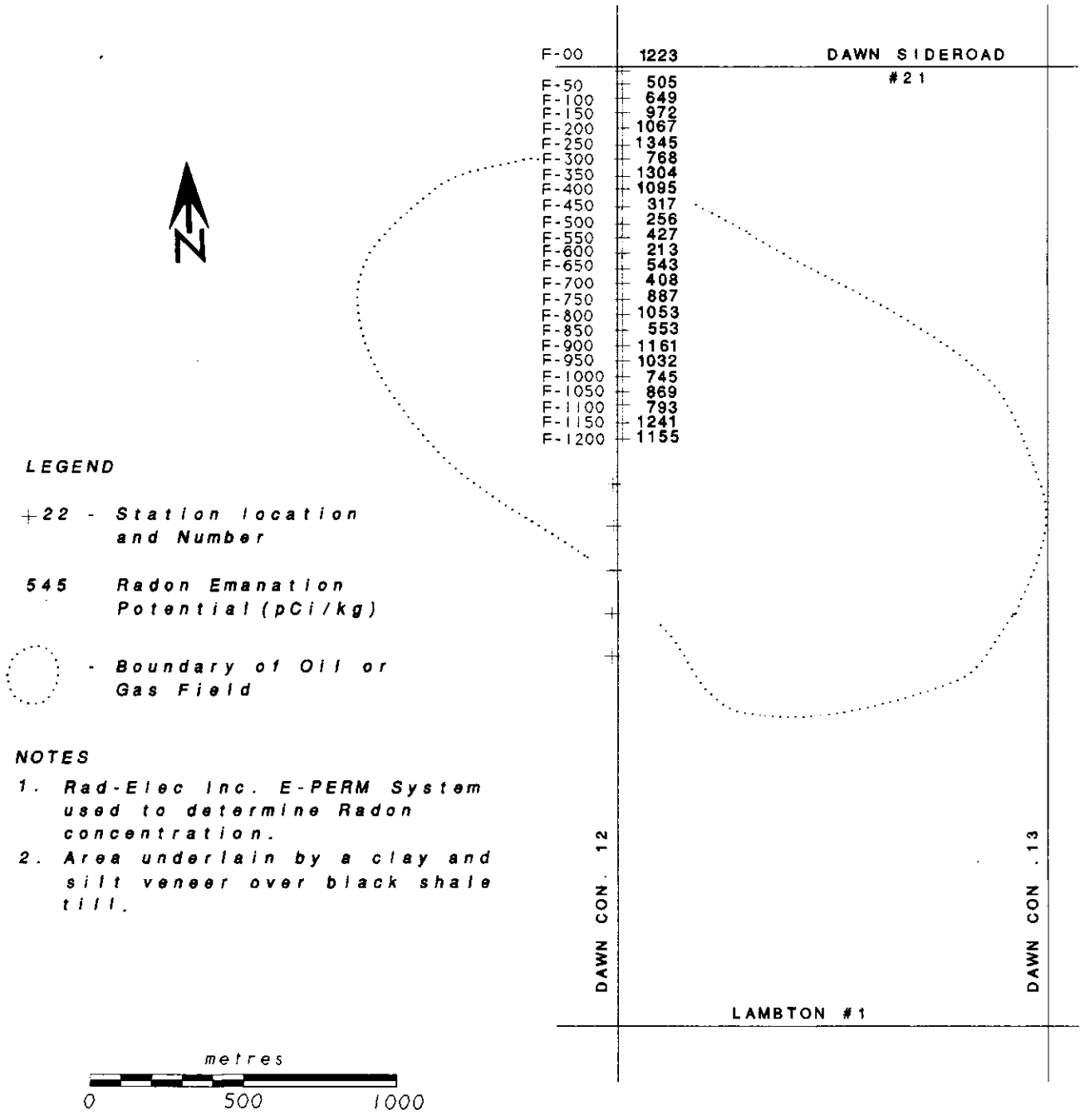
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

FLORENCE - OAKDALE OIL FIELD

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure FL-4



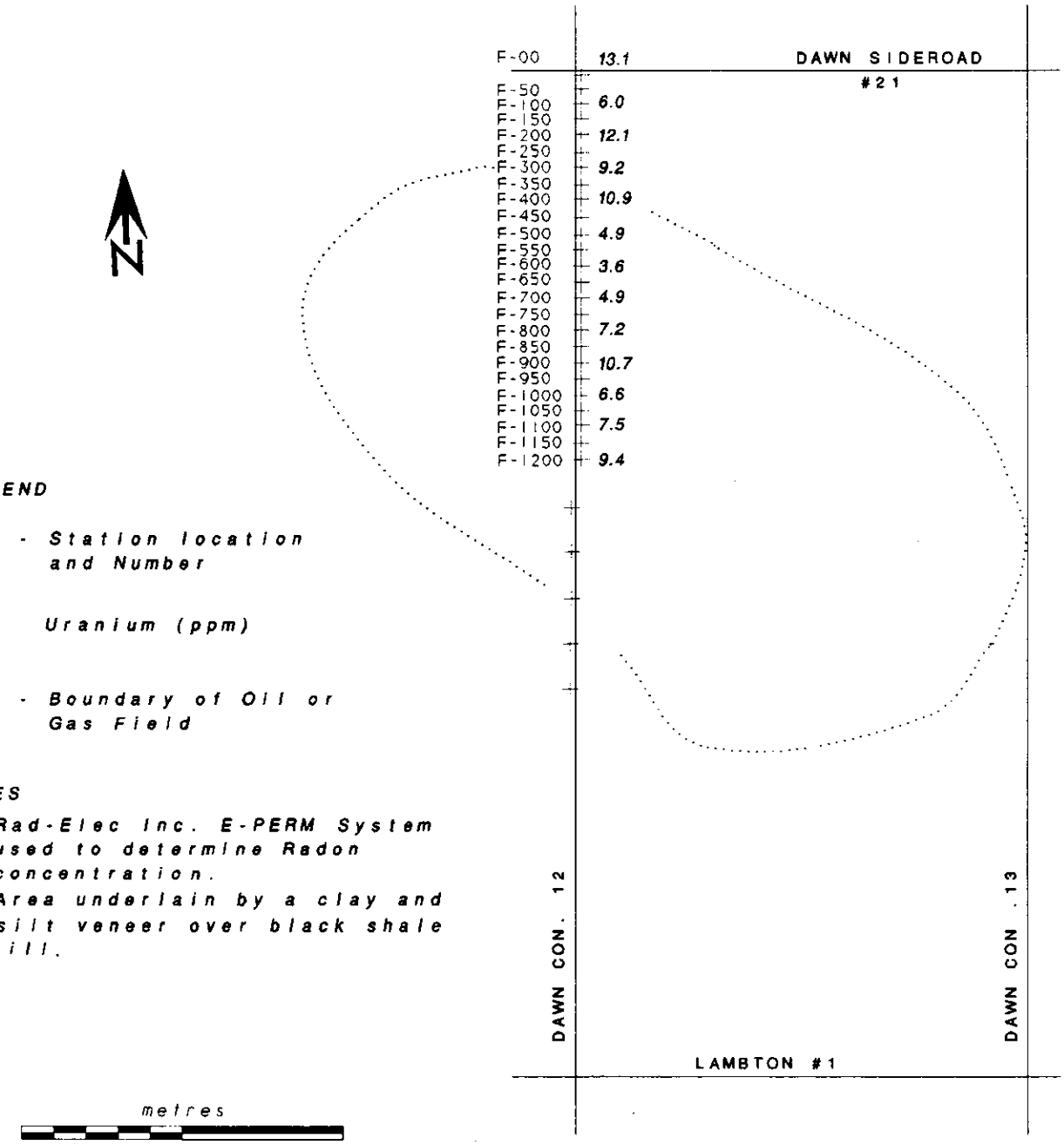
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

FLORENCE - OAKDALE OIL FIELD

RADON EMANATION POTENTIAL RESULTS

Figure FL-5



ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

FLORENCE - OAKDALE OIL FIELD

URANIUM GEOCHEMICAL RESULTS

Figure FL-6

OIL CITY [Enniskillen 1-16-IV Pool] (Silurian)
Figures OC-1, OC-2, OC-3, OC-4, OC-5, OC-6.

Location	U.T.M. 4736000N, 408300E 17T MT
	Enniskillen Township, Conc.
Surficial Geology	Black Shale Till
Drift Thickness	20 - 25 m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Unit	?
Depth Below Surface	?
Type of Reservoir	?

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
241.1	595.0	22.0	178.2	603.3	879.0	290.0	146.9

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
233.99	647.8	11.4	193.7	238.6	633.3	17.2	187.3

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.78	0.75	0.47	0.57	0.47	0.60	0.49	0.42

The Oil City or Enniskillen 1-16-IV pool has been in production since 1975 and lies just east of the intersection of Highways 80 and 21. It is bisected by a northward trending abandoned railroad right of way. This is described as a small pinnacle reef, reasonably well defined but having no published structural details.

Two sample profiles, one along Highway 80 and the other along the railroad right of way were established. Since this is a relatively small field, a total of 26 soil gas locations and 31 soil samples were taken.

The soils of the east-trending profile were well drained, while the north-trending profile was in poorly drained soils. Soil gas radon results were generally high in the eastern part of the field rising to

595 pCi/L over a background of 50 to 100 pCi/L. There is a slight correlation (0.47) of soil gas radon values with radon emanation results.

Figure OC-1
Oil City Gas Field: Comparison between
Soil Gas and Emanation Potential Results

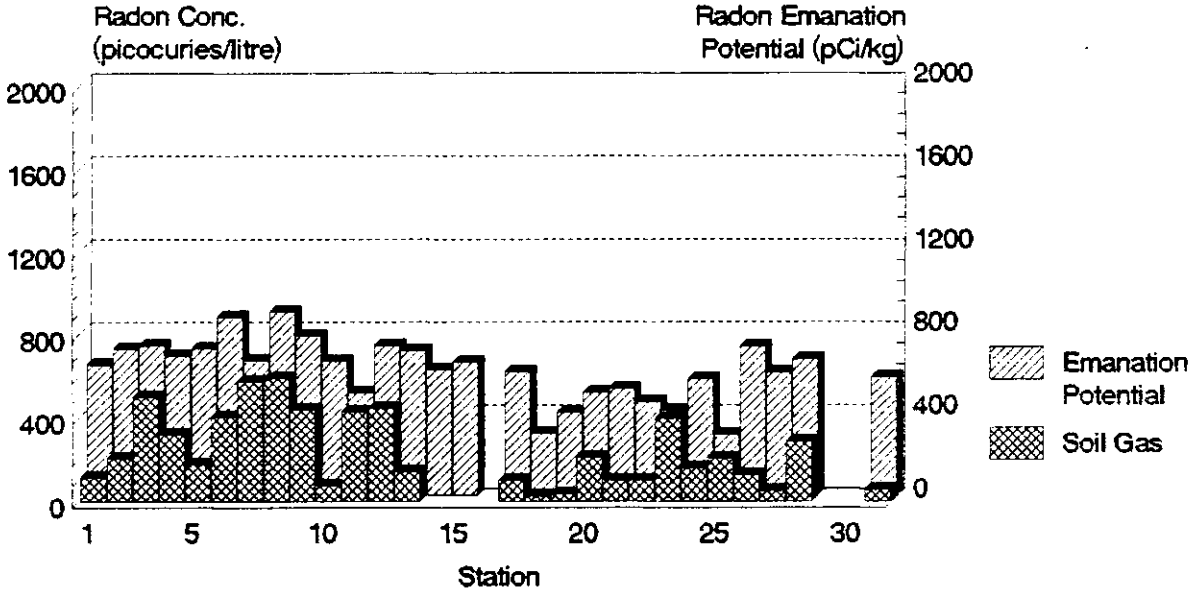
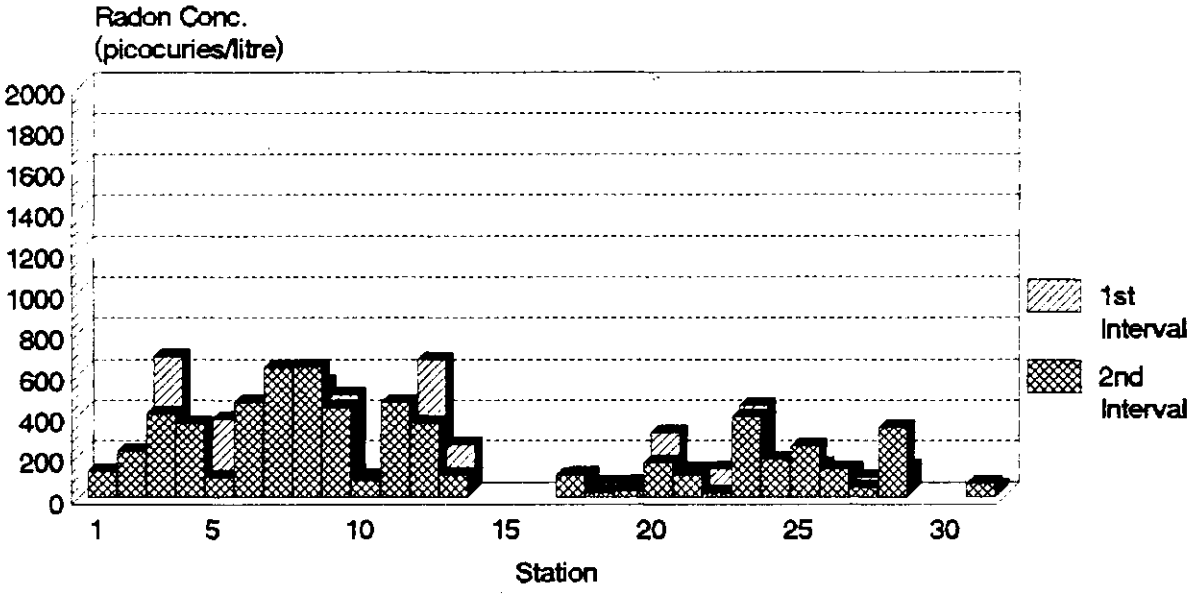
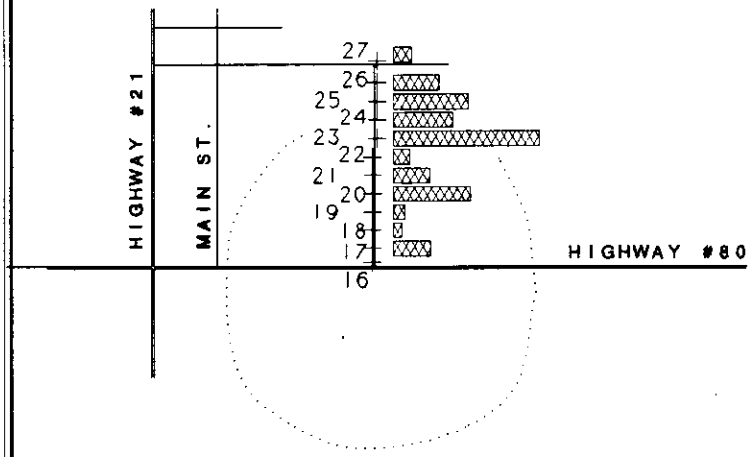


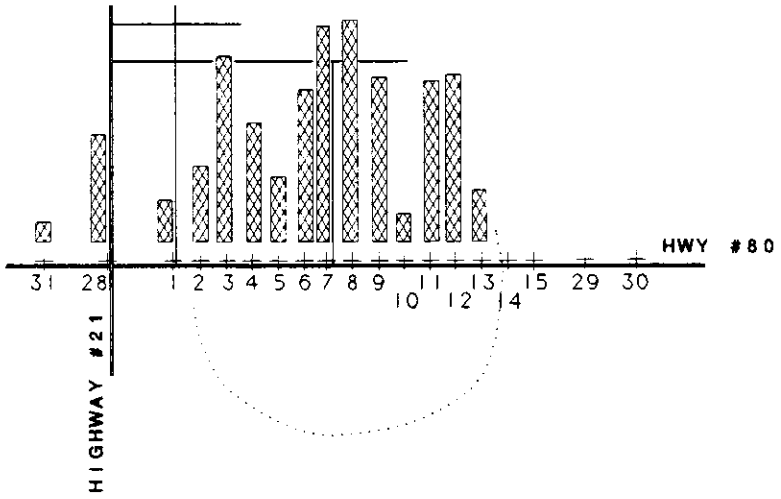
Figure OC-2
Oil City Gas Field: Soil Radon Gas
Concentrations 1st and 2nd Intervals



NORTH - SOUTH PROFILE



EAST - WEST PROFILE



LEGEND

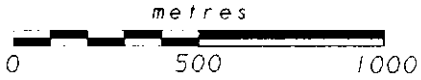
+ 22 - *Station location and Number (all stations prefixed by OC)*

- *Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



ONTARIO GEOLOGICAL SURVEY

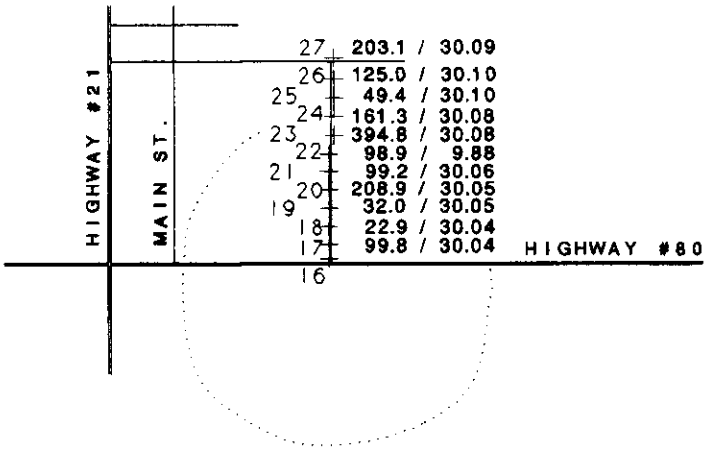
RADON HYDROCARBON EXPLORATION STUDY

OIL CITY GAS FIELD

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure OC-3

NORTH - SOUTH PROFILE



LEGEND

+ 22 - Station location and Number (all stations prefixed by OC)

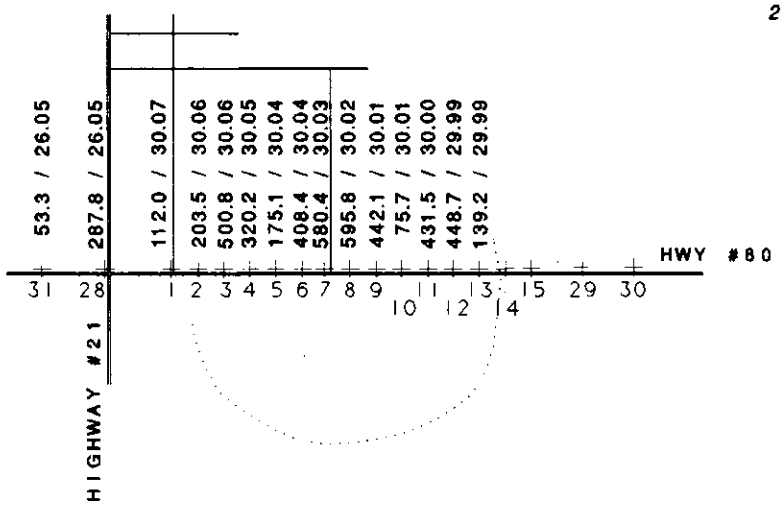
99.0/ 22.00 - Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)

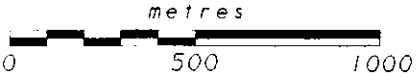
- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.

EAST - WEST PROFILE





ONTARIO GEOLOGICAL SURVEY

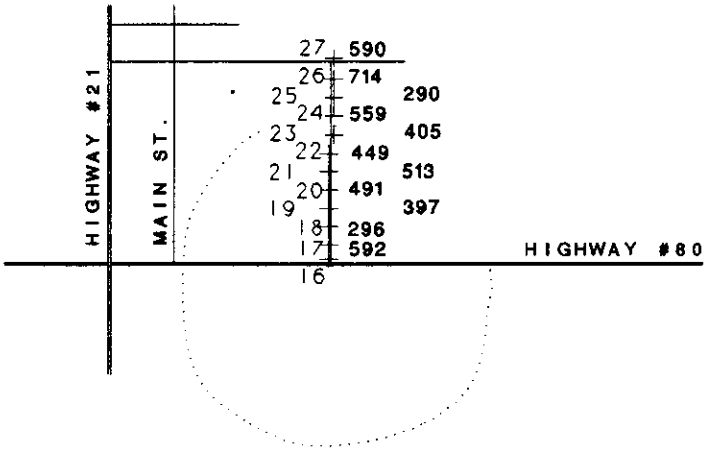
RADON HYDROCARBON EXPLORATION STUDY

OIL CITY GAS FIELD

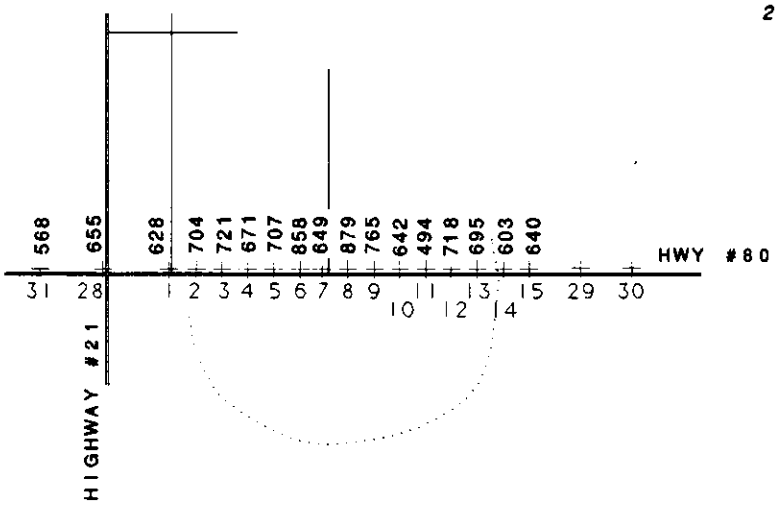
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure OC-4

NORTH - SOUTH PROFILE



EAST - WEST PROFILE



LEGEND

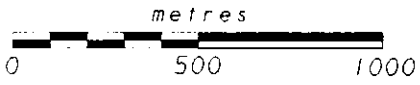
+ 22 - *Station location and Number (all stations prefixed by OC)*

545 *Radon Emanation Potential (pCi/kg)*

- *Boundary of Oil or Gas Field*

NOTES

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration.*
2. *Area underlain by black shale till.*



ONTARIO GEOLOGICAL SURVEY

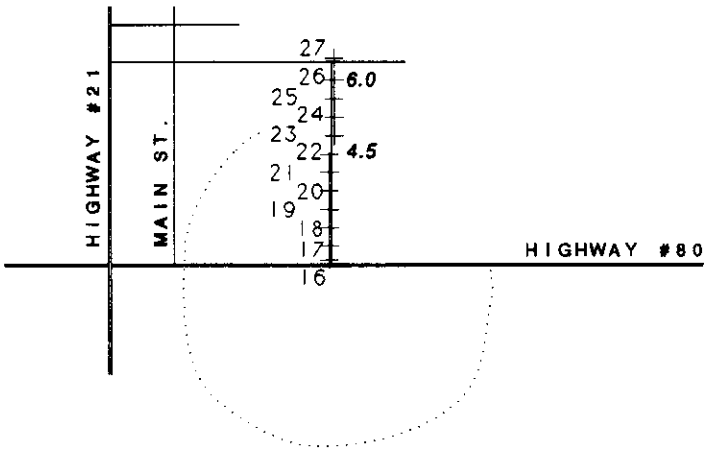
RADON HYDROCARBON EXPLORATION STUDY

OIL CITY GAS FIELD

RADON EMANATION POTENTIAL RESULTS

Figure OC-5

NORTH - SOUTH PROFILE



LEGEND

+ 22 - Station location and Number (all stations prefixed by OC)

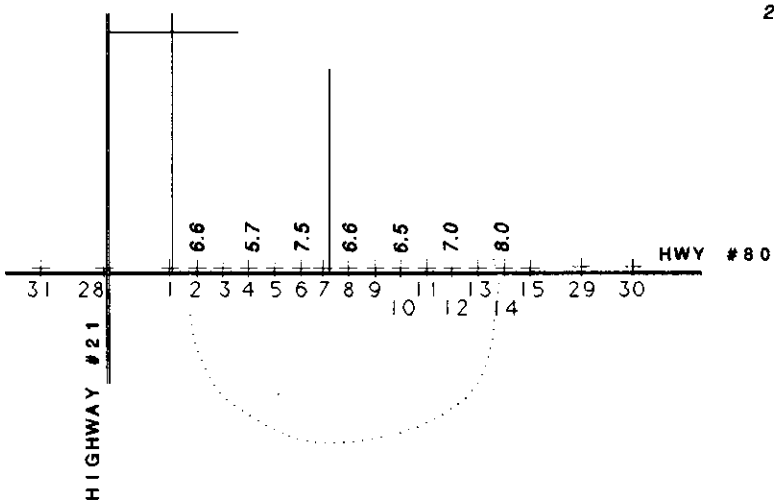
1.8 Uranium (ppm)

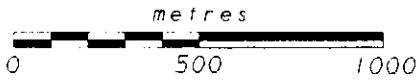
- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain black shale till.

EAST - WEST PROFILE





ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

OIL CITY GAS FIELD

URANIUM GEOCHEMICAL RESULTS

Figure OC-6

OIL SPRINGS (Anthropogenic influences of oil production)
Figures OS-1, OS-2, OS-3, OS-4, OS-5, OS-6.

Location	U.T.M. 4736000N, 408300E 17T MT
Surficial Geology	Black Shale Till
Drift Thickness	15 m - 20 m
Underlying Bedrock	Kettle Point Fm. & Hamilton Fm.
Hydrocarbon Bearing Strata	Dundee Formation
Depth Below Surface	20 m - 400 m
Type of Reservoir	?

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
182.1	734.2	10.2	141.1	698.5	1282	392	162.2

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
160.5	394.4	24.6	99.0	188.72	838.31	5.82	162.5

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.67	1.10	0.17	0.18	0.38	0.22	0.21	0.19

The Village of Oil Springs is located in Enniskillen Township, on Highway 21.

Oil production was first recorded at Oil Springs in 1858 from shallow wells dug by hand in the glacial till. The field has produced continuously since discovery. In 1913 oil began to be recovered from depths of 560 to 600 m below surface.

The village has been a center of petroleum production and storage since 1858 to the present. A review of the history of oil production and handling was made and soil samples taken from sites adjacent to the original discovery, beside current production facilities, and near historic oil storage and transfer points.

This area is flat with heavy clay soils that were very poorly drained to saturated during this

survey. Soil gas radon concentrations ranged from 10.2 pCi/L to 734.2 pCi/L. Radon emanation potentials are in the order of 600 pCi/kg with several spikes to 900 pCi/kg and one spike that is greater than 1200 pCi/kg. There appears to be less contribution to radium content of the soil from handling of oil (spillage) than was expected.

Figure OS-1
Oil Springs: Comparison between Soil Gas and Emanation Potential Results

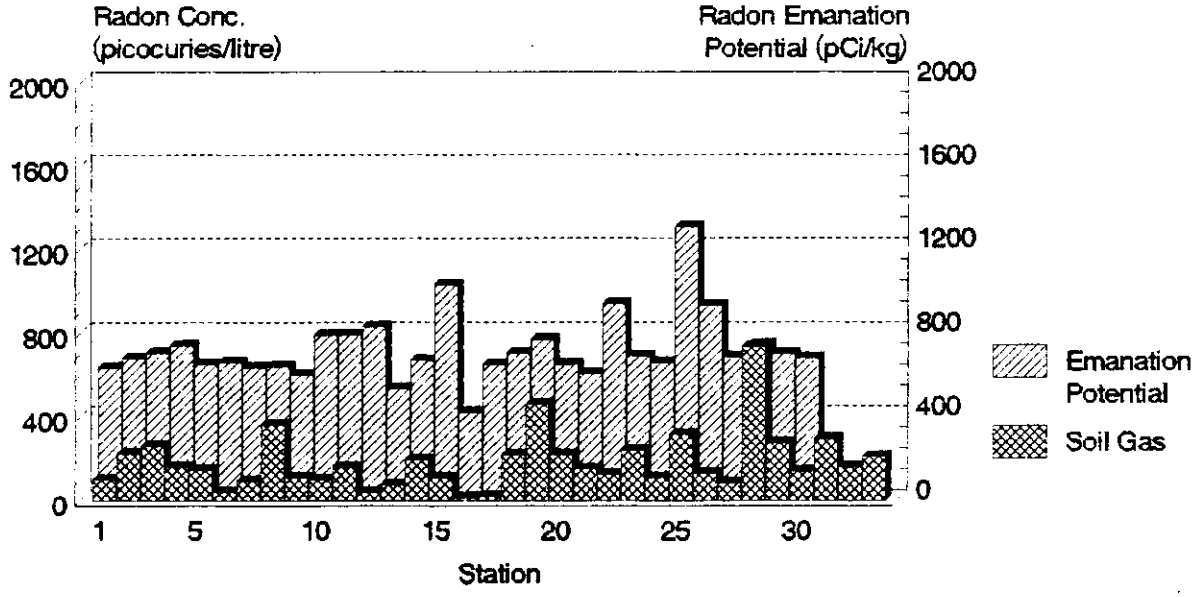
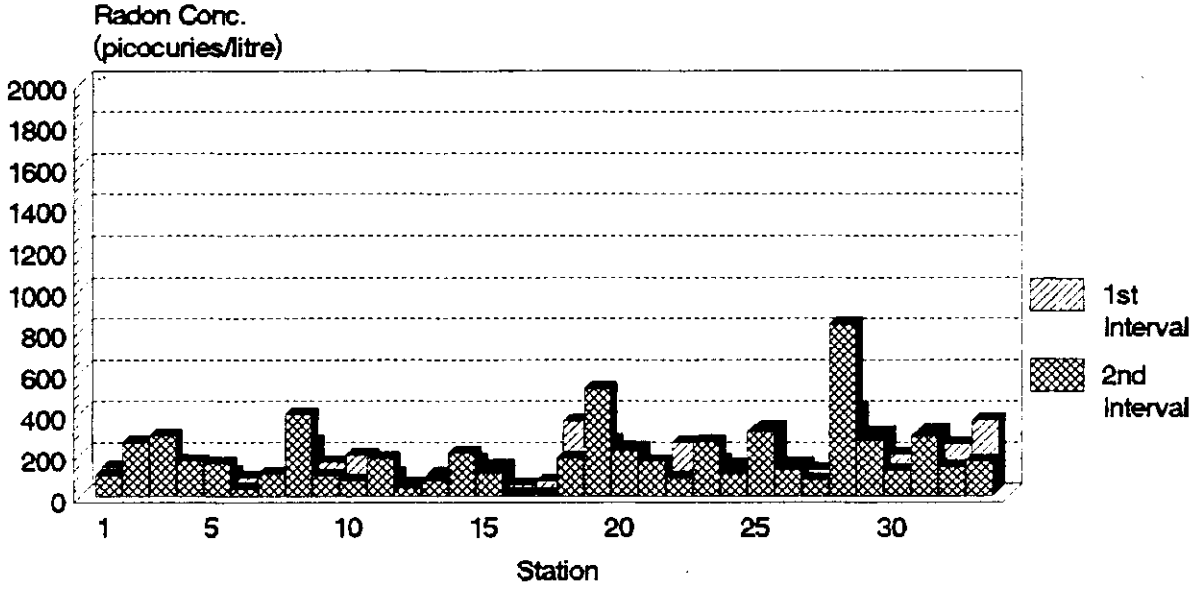
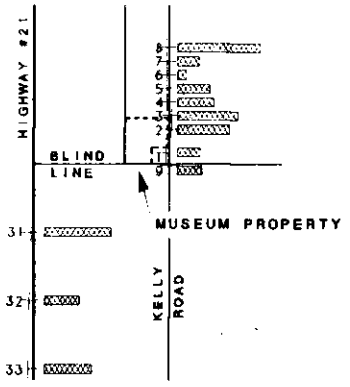


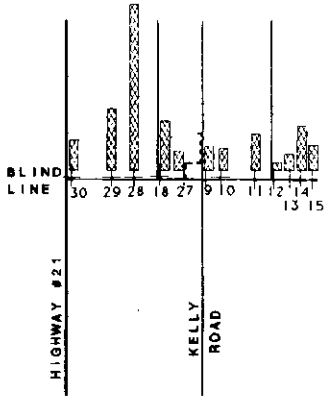
Figure OS-2
Oil Springs: Soil Radon Gas Concentrations 1st and 2nd Intervals



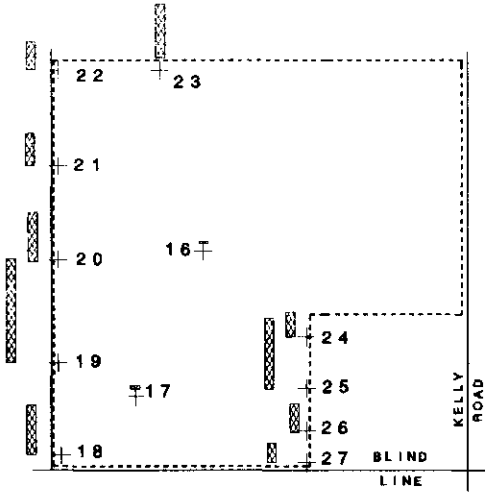
NORTH SOUTH PROFILE

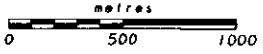


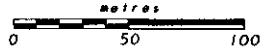
EAST WEST PROFILE



MUSEUM PROPERTY







LEGEND

- 22 - Station location and Number (all stations prefixed by OS)
- Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L
- Boundary of Oil or Gas Field

NOTES

1. Red-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.

ONTARIO GEOLOGICAL SURVEY

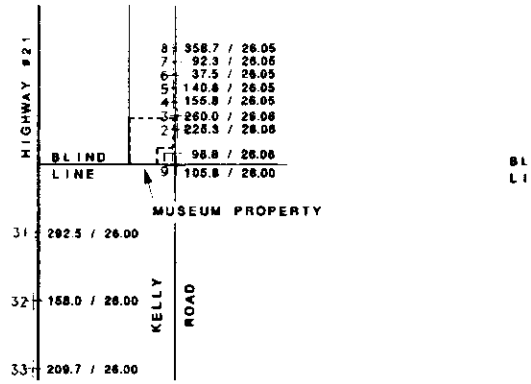
RADON HYDROCARBON EXPLORATION STUDY

OIL SPRINGS AREA

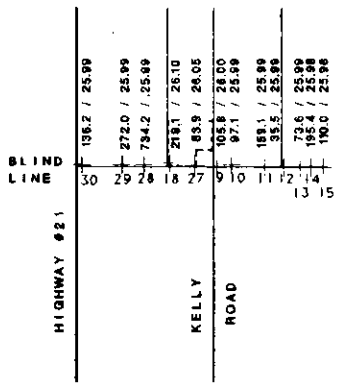
SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure OS-3

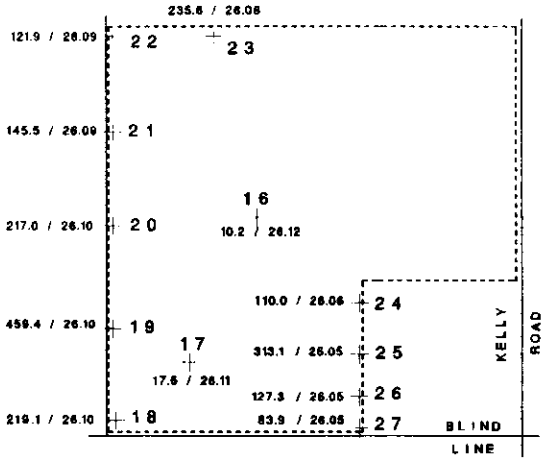
NORTH SOUTH PROFILE

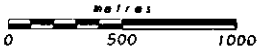


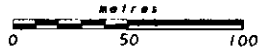
EAST WEST PROFILE



MUSEUM PROPERTY







LEGEND

- 22 - Station location and Number (all stations prefixed by OS)
- 99.0/22.00 Soil Radon Gas Concentration (pCi/L) / Exposure Time (days)
- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale (III).

ONTARIO GEOLOGICAL SURVEY

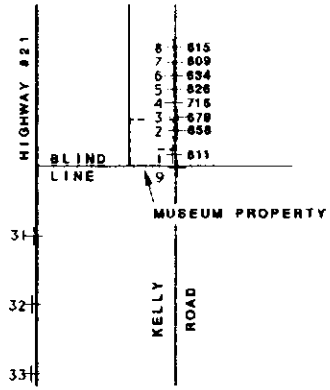
RADON HYDROCARBON EXPLORATION STUDY

OIL SPRINGS AREA

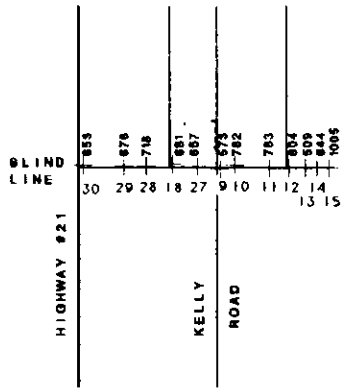
SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure OS-4

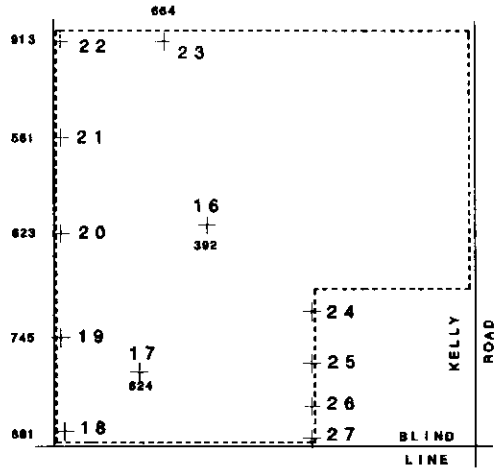
NORTH SOUTH TRAVERSE

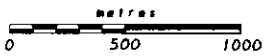


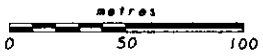
EAST WEST TRAVERSE



MUSEUM PROPERTY







LEGEND

· 22 - Station location and Number (all stations prefixed by OS)

545 Radon Emanation Potential (pCi/kg)

Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.

ONTARIO GEOLOGICAL SURVEY

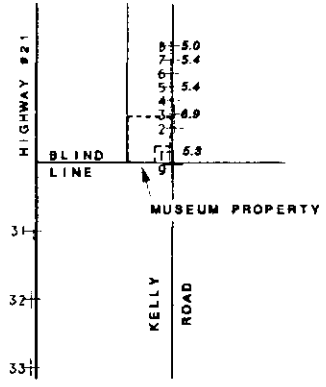
RADON HYDROCARBON EXPLORATION STUDY

OIL SPRINGS AREA

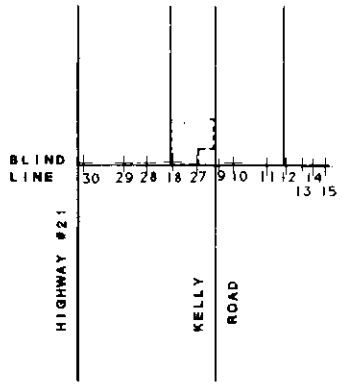
RADON EMANATION POTENTIAL RESULTS

FIGURE OS-5

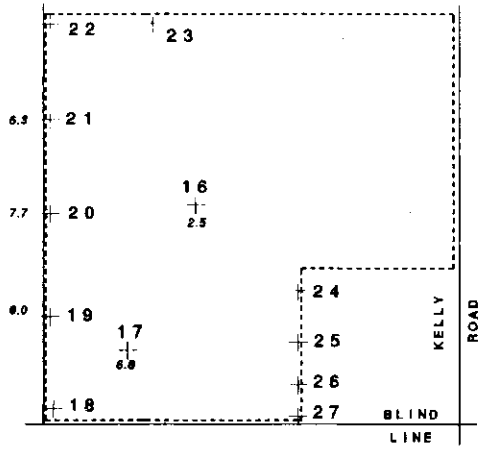
NORTH SOUTH PROFILE

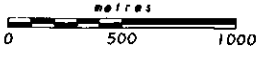


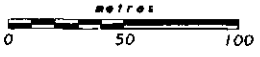
EAST WEST PROFILE



MUSEUM PROPERTY







LEGEND

· 22 - Station location and Number (all stations prefixed by OS)

1.8 Uranium (ppm)

- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by black shale till.

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

OIL SPRINGS AREA

URANIUM GEOCHEMICAL RESULTS

Figure OS-6

TERMINUS NORTH (Silurian incipient reef)
Figures TN-1, TN-2, TN-3, TN-4, TN-5, TN-6.

Area	Terminus North
Location	U.T.M. 4727100N, 390500E, 17T LT
Surficial Geology	Black Shale Till
Drift Thickness	37 m
Underlying Bedrock	Kettle Point Formation shale
Hydrocarbon Bearing Strata	Guelph Formation
Depth Below Surface	595 m
Type of Reservoir	Incipient reef

STATISTICAL SUMMARY

Soil Radon Gas (Average)				Radon Emanation Potential			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
191.9	663.7	54.1	205.4	594.6	700.0	499.0	52.5

Soil Radon Gas 1st interval				Soil Radon Gas 2nd interval			
Mean	Maximum	Minimum	S.D.	Mean	Maximum	Minimum	S.D.
181.7	504.8	31.8	137.3	197.24	787.62	6.19	247.0

Correlation Coefficients and Slope of Regression Lines

1st Interval vs 2nd Interval		2nd Interval vs R.E.P.		1st Interval vs R.E.P.		Average vs R.E.P.	
c.c	Slope	c.c	Slope	c.c	Slope	c.c	Slope
0.86	1.54	-0.10	-0.49	-0.02	-0.07	-0.09	-0.35

This field has had a relatively small oil production between 1969 and 1972. Records indicate a show of gas, but no production.

The soils along the east-west profile line (Sombra Concession 11) are poorly drained and were very wet to flooded during the 1992 survey.

Figure TN-1
Terminus North Field: Comparison between
Soil Gas and Emanation Potential Results

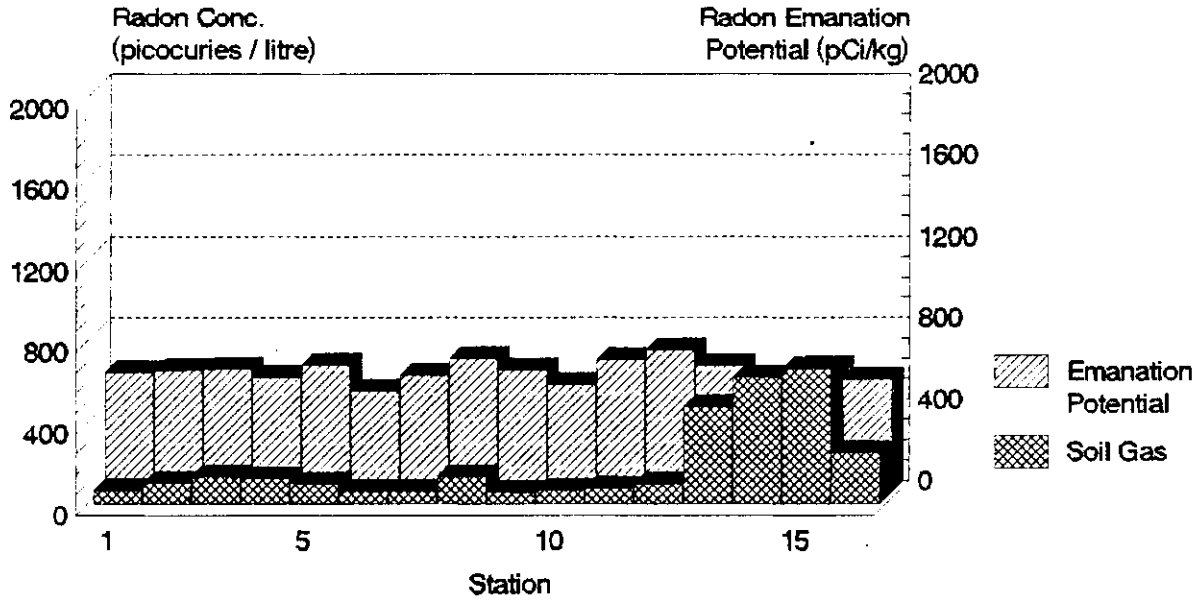
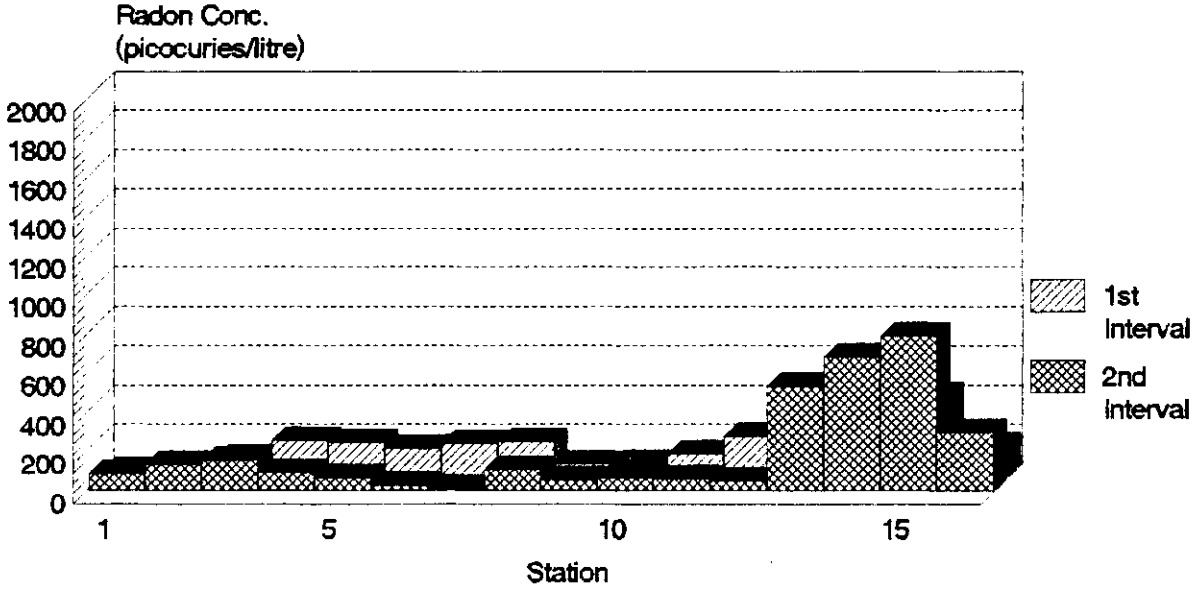
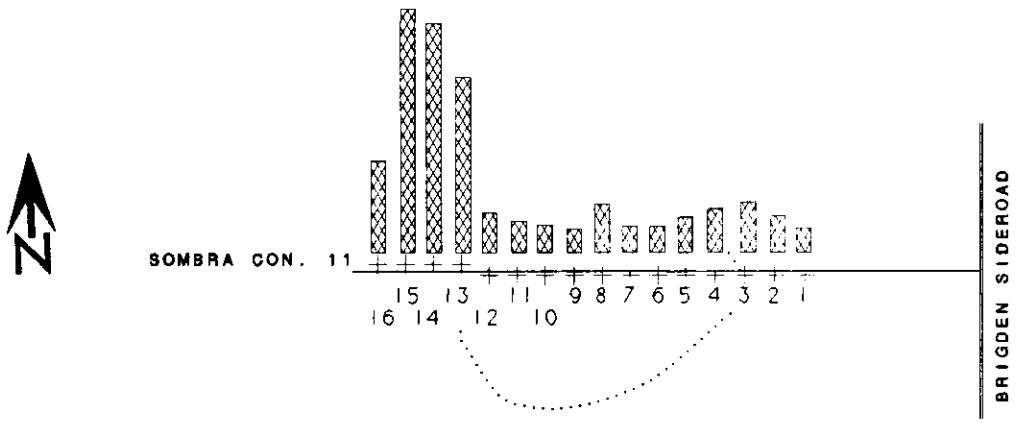


Figure TN-2
Terminus North Field: Soil Radon Gas
Concentrations 1st and 2nd Intervals





LEGEND

- 22 - Station location and Number (all stations prefixed by TN)

- Bar showing Soil Radon Gas concentration Scale 1cm = 200 pCi/L

- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.

metres

0 500 1000

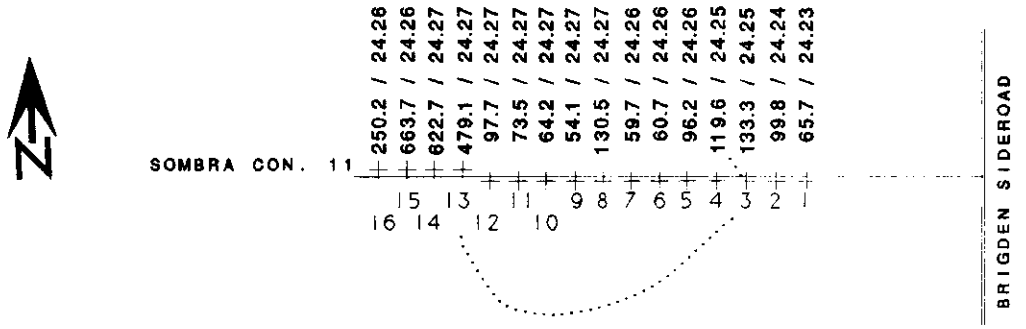
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

TERMINUS NORTH OIL FIELD

SOIL RADON GAS RESULTS - GRAPHICAL PRESENTATION

Figure TN-3



LEGEND

- 22 - Station location and Number (all stations prefixed by TN)

99.0/ 22.00 — Soil Radon Gas Concentration (pCI/L) / Exposure Time (days)

- Boundary of Oil or Gas Field

NOTES

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration.
2. Area underlain by a clay and silt veneer over black shale till.

metres

0 500 1000

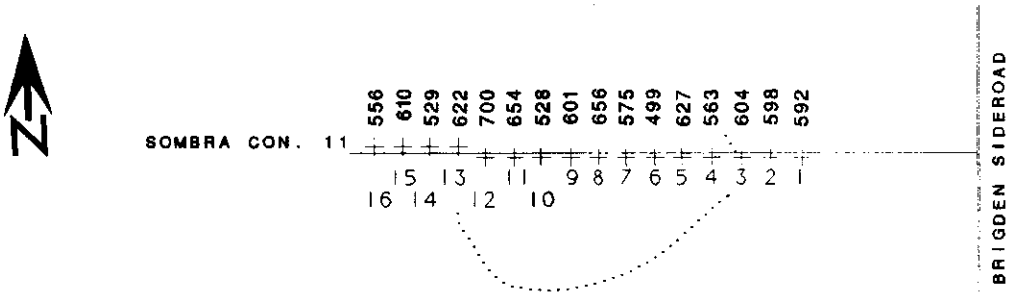
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

TERMINUS NORTH OIL FIELD

SOIL RADON GAS RESULTS - NUMERIC PRESENTATION

Figure TN-4



LEGEND

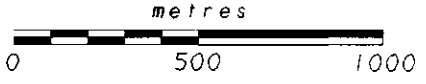
- 22 - Station location and Number (all stations prefixed by TN)

545 Radon Emanation Potential (pCi/kg)

- Boundary of Oil or Gas Field

NOTE

1. Rad-Elec Inc. E-PERM System used to determine Radon concentration



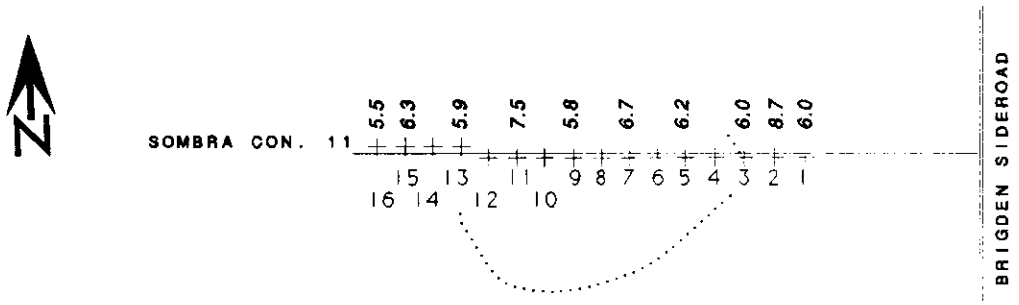
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

TERMINUS NORTH OIL FIELD

RADON EMANATION POTENTIAL RESULTS

Figure TN-5



LEGEND

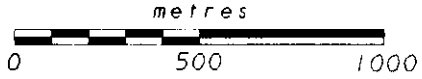
22 - *Station location and Number (all stations prefixed by TN)*

1.8 *Uranium (ppm)*

- *Boundary of Oil or Gas Field*

NOTE

1. *Rad-Elec Inc. E-PERM System used to determine Radon concentration*



ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

TERMINUS NORTH OIL FIELD

URANIUM GEOCHEMICAL RESULTS

Figure TN-6

VERTICAL SOIL PROFILE DATA

Soil samples were taken from vertical profiles at representative locations in Control Area 1, Control Area 2, Control 3, Area Coveny, Chatham, Dawn Gas, and Oil Springs study areas.

Radon emanation potential measurements were done on all the profiles described, as well as gamma ray spectrometer radium assays, and uranium assays, on selected samples from the profiles.

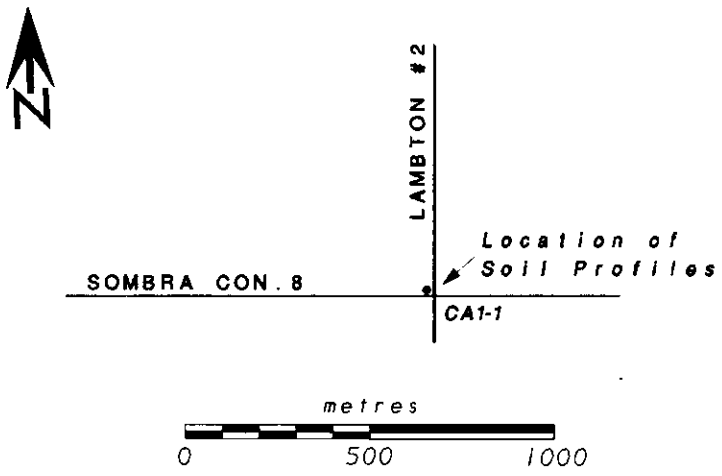
In several areas, 4 profiles were grouped 1 m north, south, east, and west of a central point. This was to permit comparison of results to determine likely variation in apparent radium over short distances.

Results are given in the tables presented in Appendix IV, and further illustrated graphically in figures P-1 to P-30.

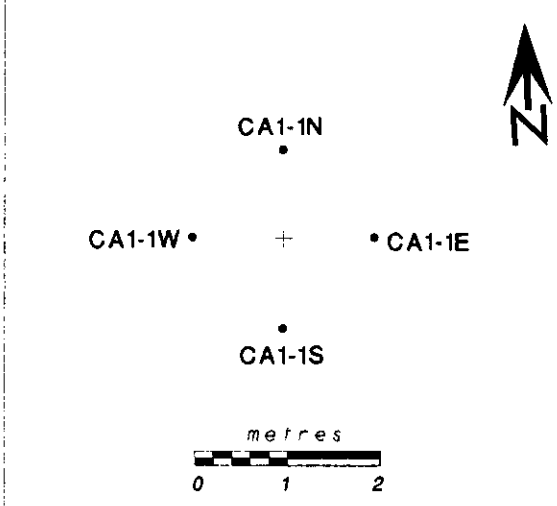
INTERPRETATION OF SOIL PROFILES

The radium content of the soils studied tends to increase with depth. In poorly drained, heavy clay soils, seem to have maximum radium values at depths of 60 cm to 100 cm below surface. Although the study area is presently drained to permit farming, and the "average" water table has been lowered by the tile and drain systems, the historic water table is reflected by the radium concentration peaks.

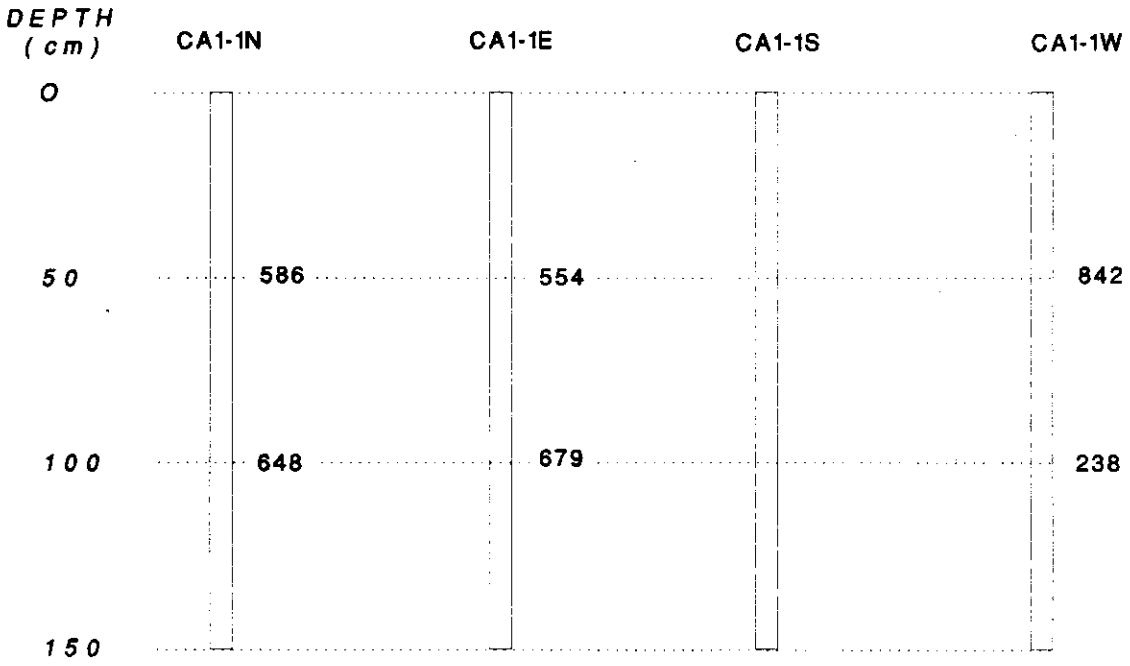
In those areas where the soil is naturally better drained the radium enhancement level appears to be deeper. The level of greatest concentration of radium is likely to be at the average water table, since radium is mobile under reducing conditions which are normally prevalent below the water table, and relatively immobile under oxidizing conditions which exist above the limit of free oxygen in the soil profile.



LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

ONTARIO GEOLOGICAL SURVEY

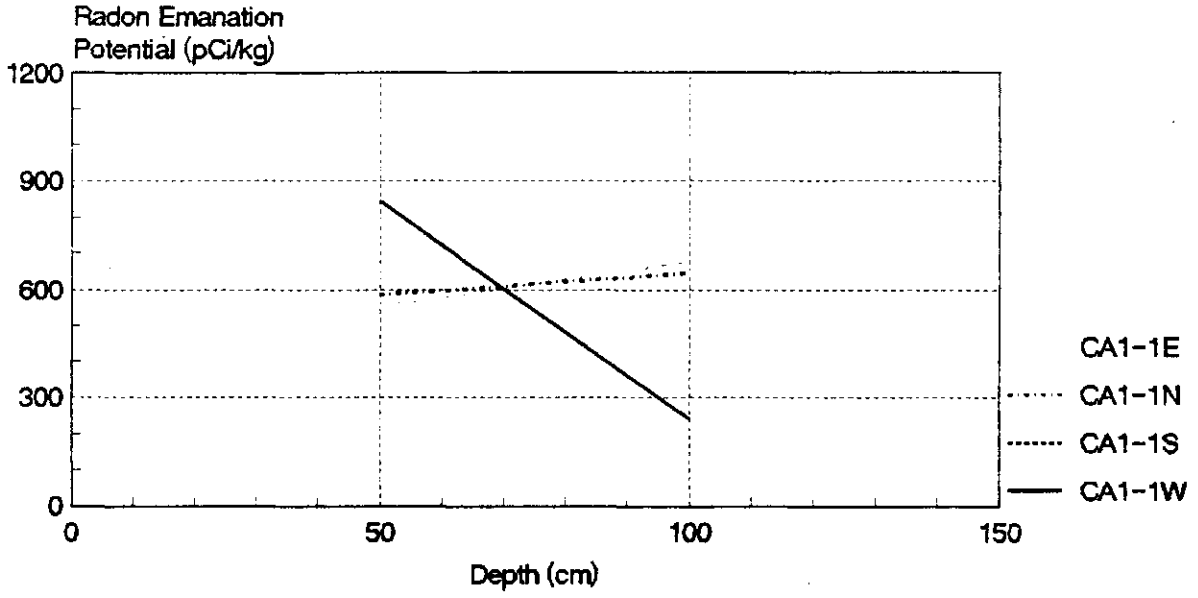
RADON HYDROCARBON EXPLORATION STUDY

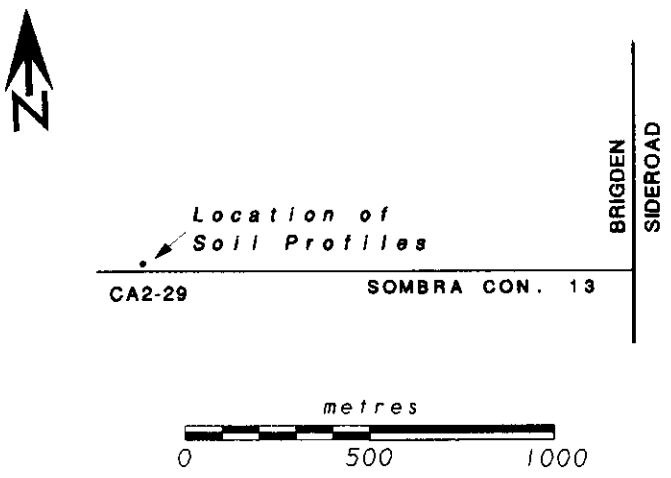
CONTROL AREA 1

SOIL PROFILE RESULTS - STATION CA1-1

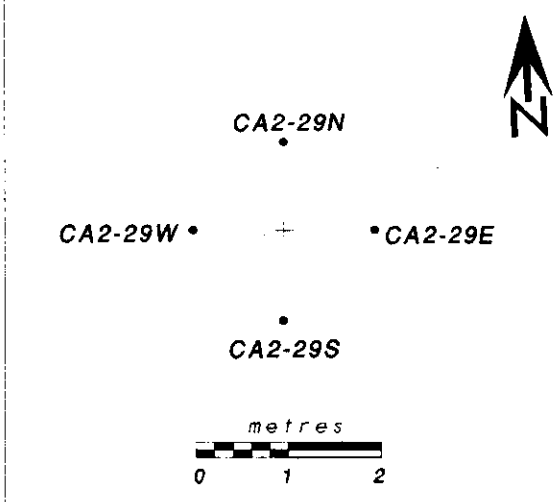
FIGURE P-1

Figure P-2
Control Area 1: Profiles - Station CA1-1
Radon Emanation Potential Results

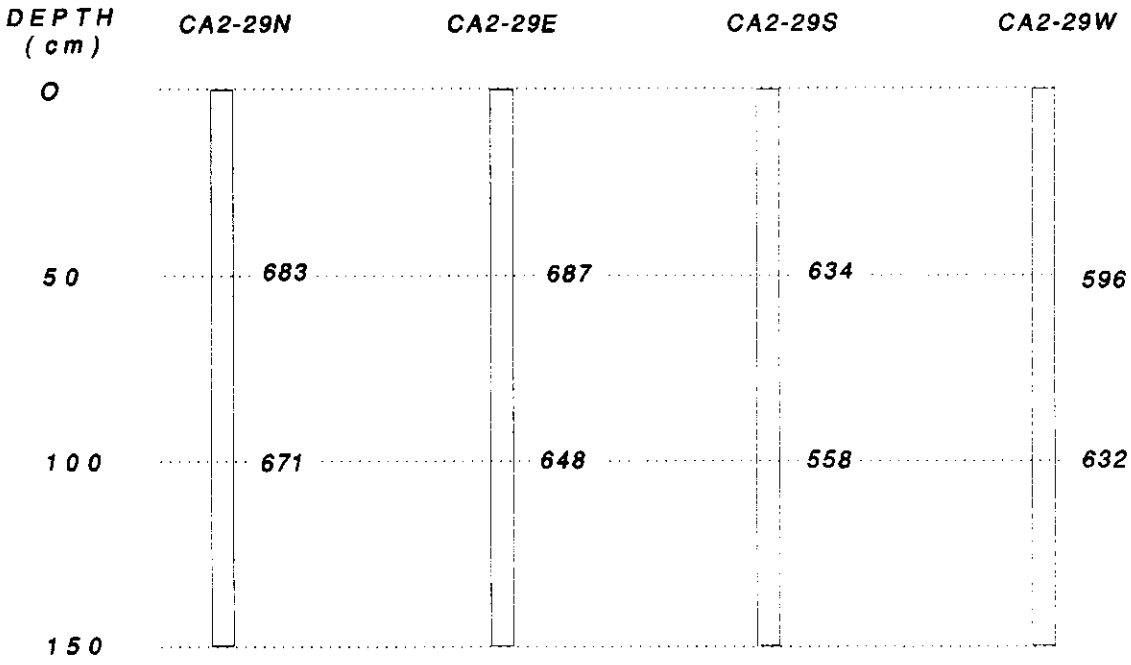




LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

ONTARIO GEOLOGICAL SURVEY

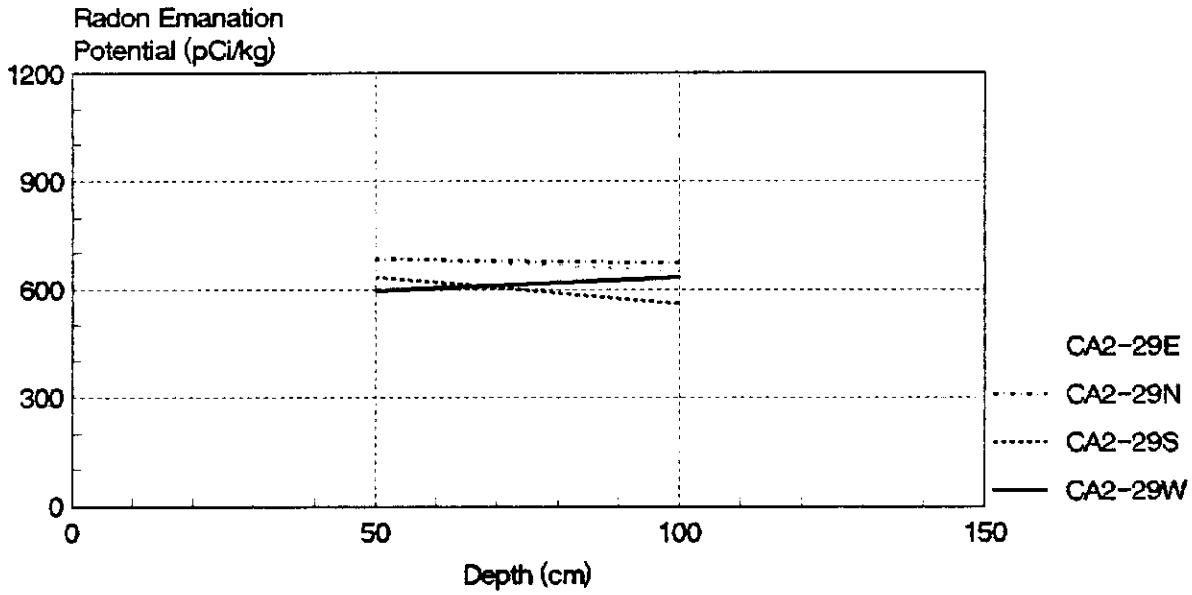
RADON HYDROCARBON EXPLORATION STUDY

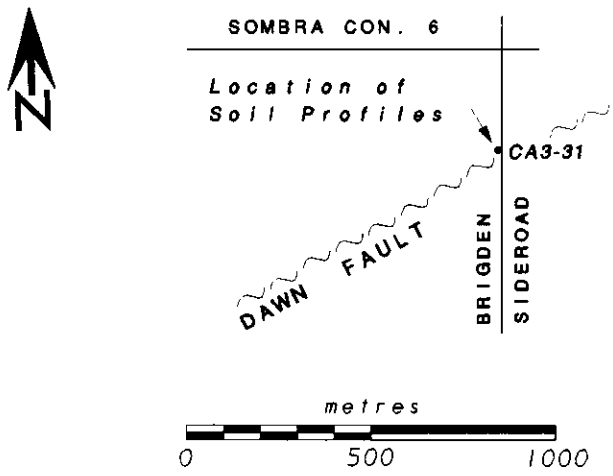
CONTROL AREA 2

SOIL PROFILE RESULTS - STATION CA2-29

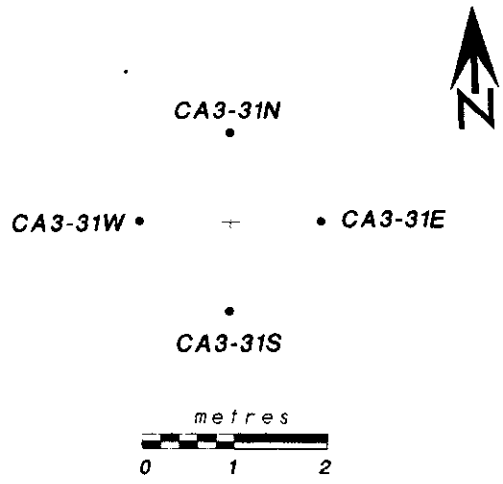
Figure P-3

Figure P-4
Control Area 2: Profiles- Station Ca2-29
Radon Emanation Potential Results

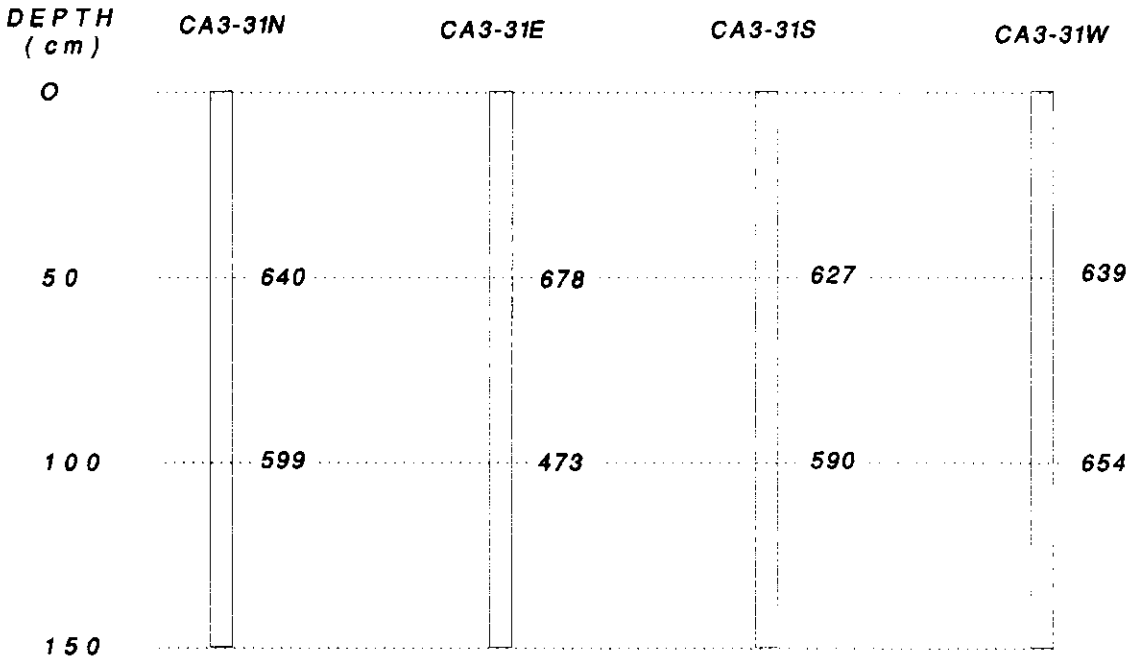




LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

ONTARIO GEOLOGICAL SURVEY

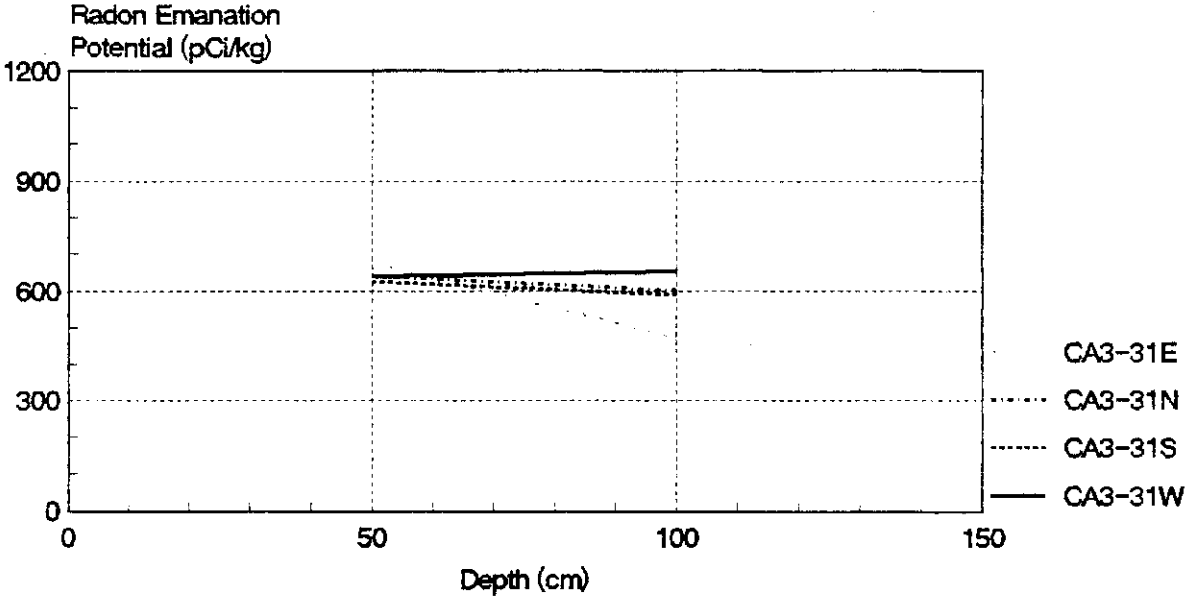
RADON HYDROCARBON EXPLORATION STUDY

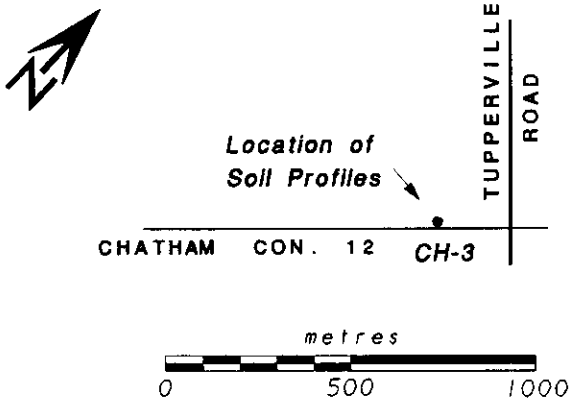
CONTROL AREA 3

SOIL PROFILE DATA - STATION CA3-31

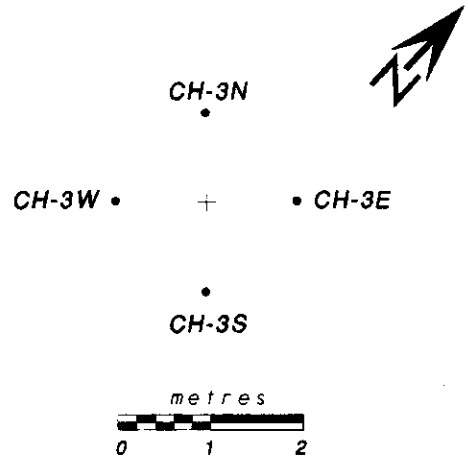
Figure P-5

Figure P-6
Control Area 3: Profiles- Station CA3-31
Radon Emanation Potential Results

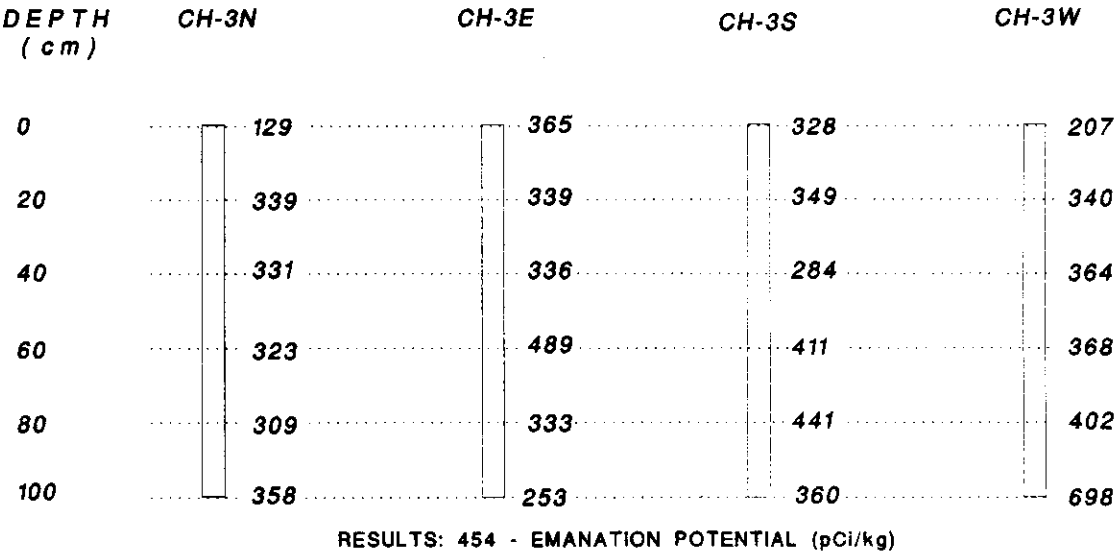




LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

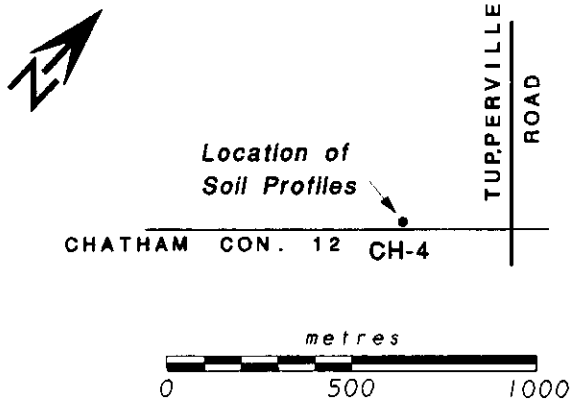
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

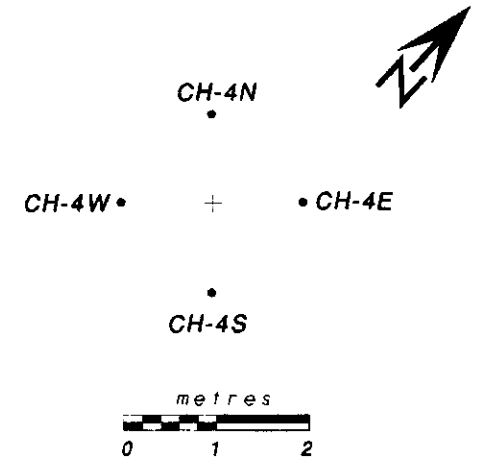
CHATHAM GAS FIELD

SOIL PROFILE RESULTS - STATION CH-3

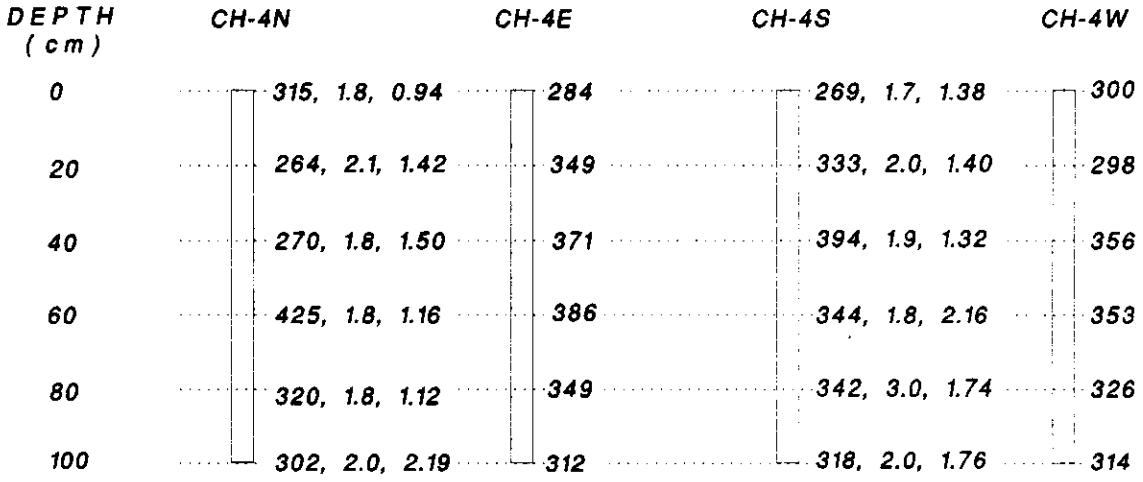
Figure P-7



LOCATION MAP



DETAIL PLAN



RESULTS: 454,1.8,3.00 - EMANATION POTENTIAL (pCi/kg), URANIUM (ppm), RADIUM (pCi/g)

PROFILES

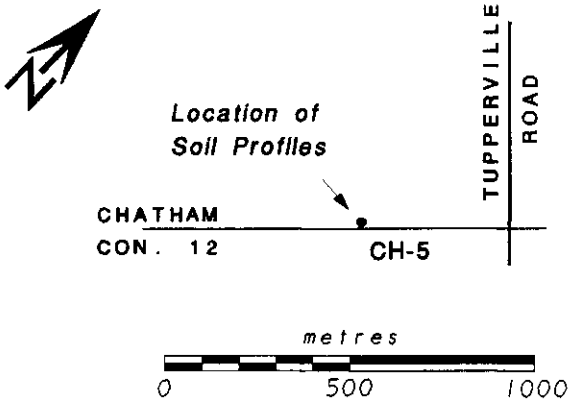
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

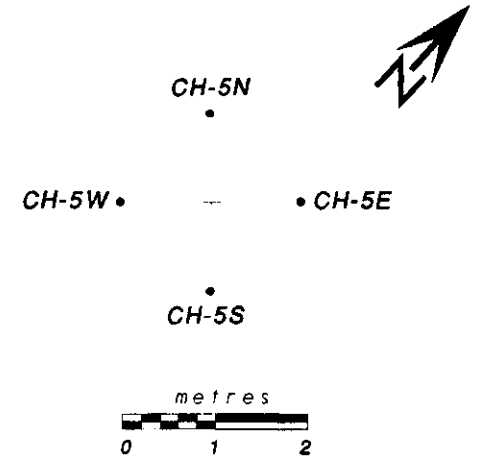
CHATHAM GAS FIELD

SOIL PROFILE RESULTS - STATION CH-4

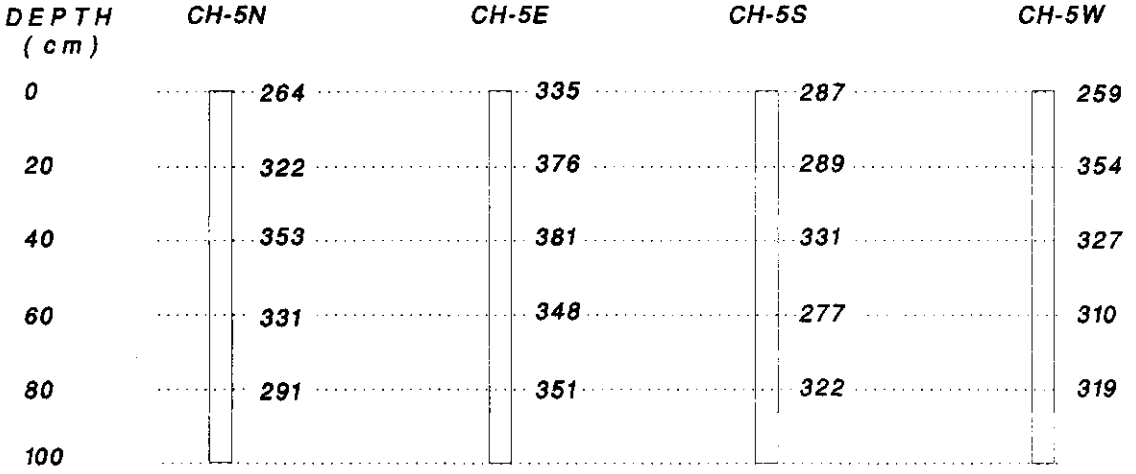
Figure P-8



LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

CHATHAM GAS FIELD

SOIL PROFILE RESULTS - STATION CH-5

Figure P-9

Figure P-10
Chatham Gas: Profiles - Station CH-3
Radon Emanation Potential Results

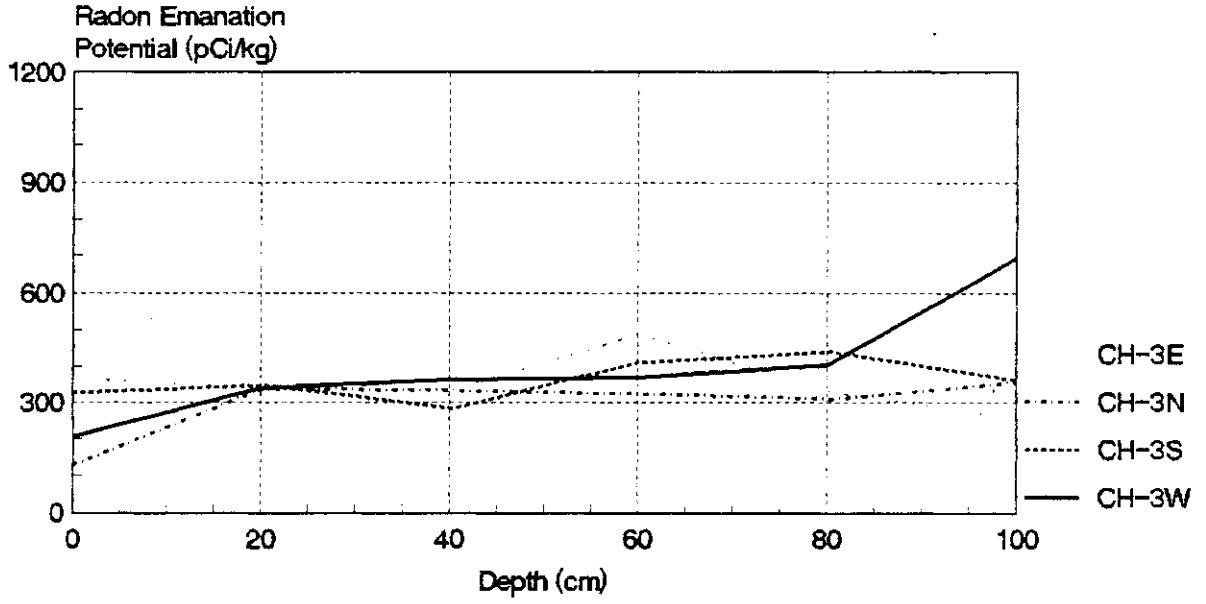


Figure P-11
Chatham Gas: Profiles - Station CH-4
Radon Emanation Potential Results

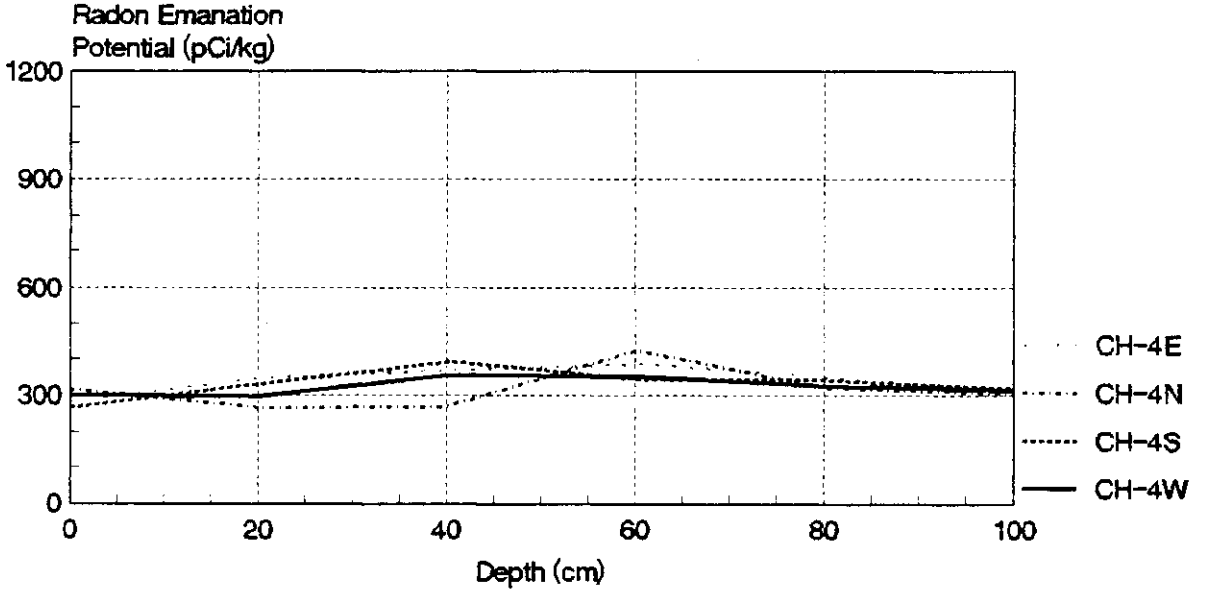


Figure P-12
Chatham Gas: Profiles - Station CH-4
Radium Results

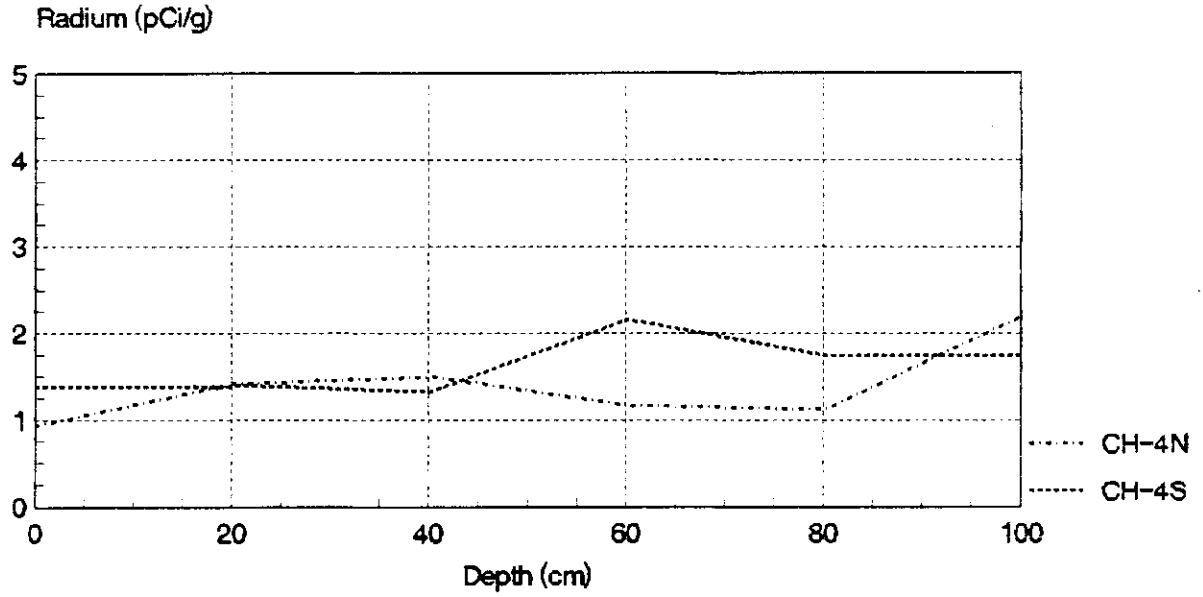


Figure P-13
Chatham Gas: Profiles - Station CH-4
Uranium Results

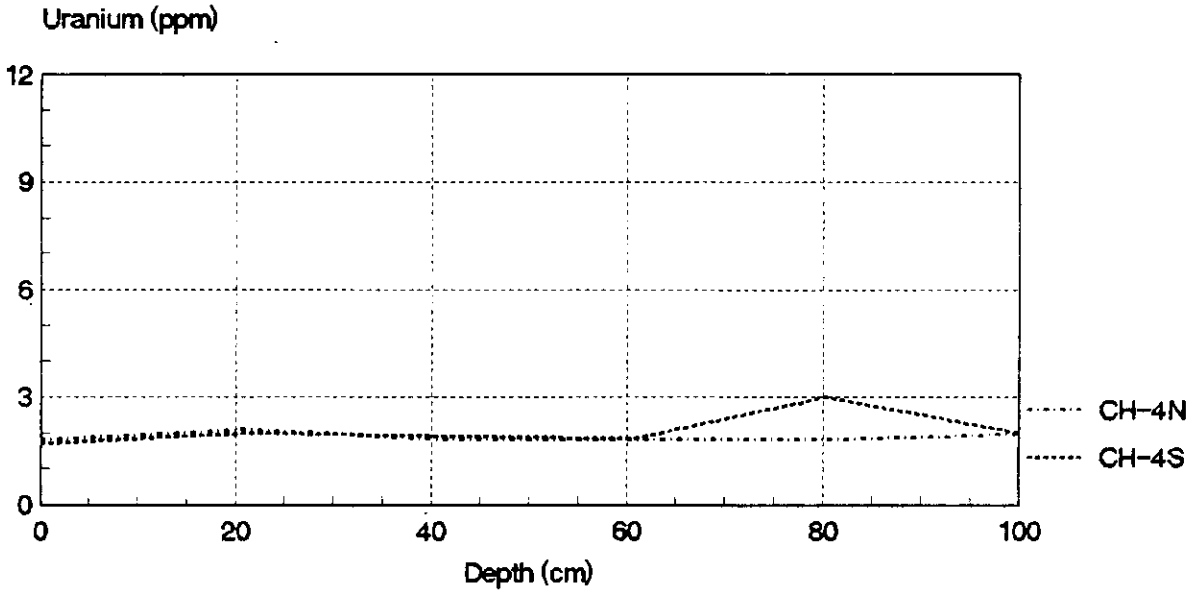


Figure P–14
Chatham Gas: Profile CH–4N: Uranium,
Radium and Emanation Potential Results

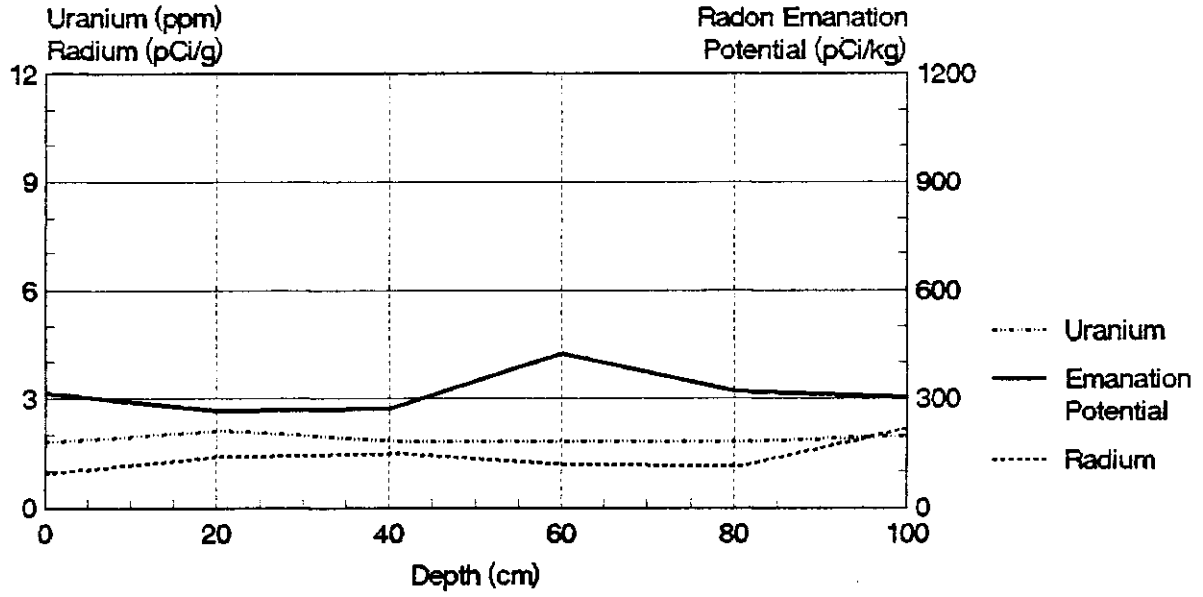


Figure P–15
Chatham Gas: Profile CH–4S: Uranium,
Radium and Emanation Potential Results

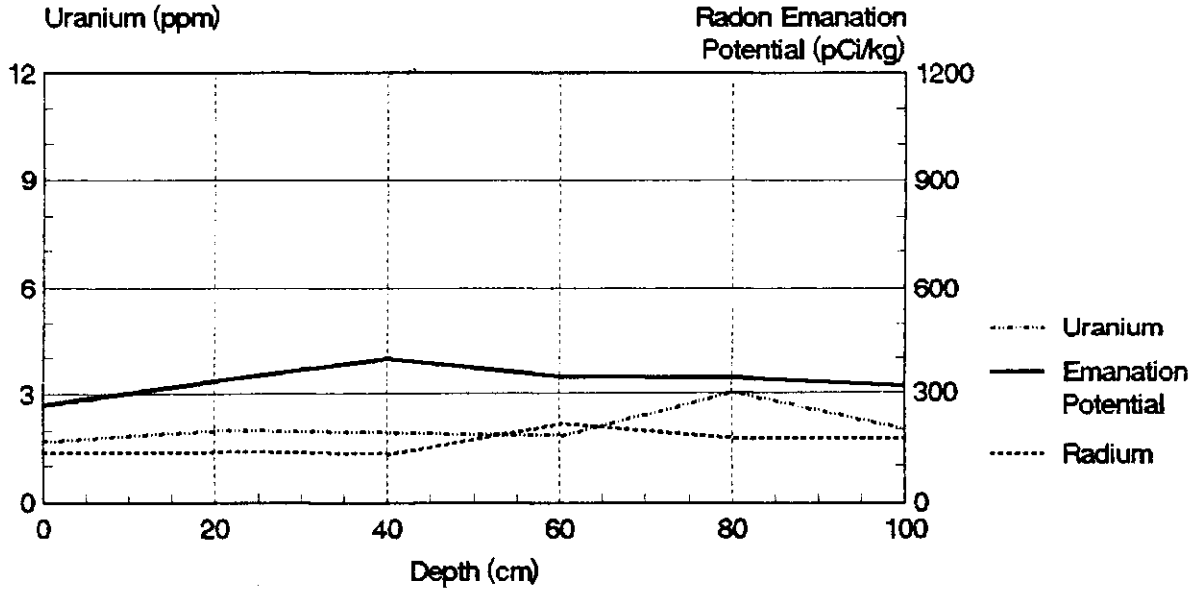
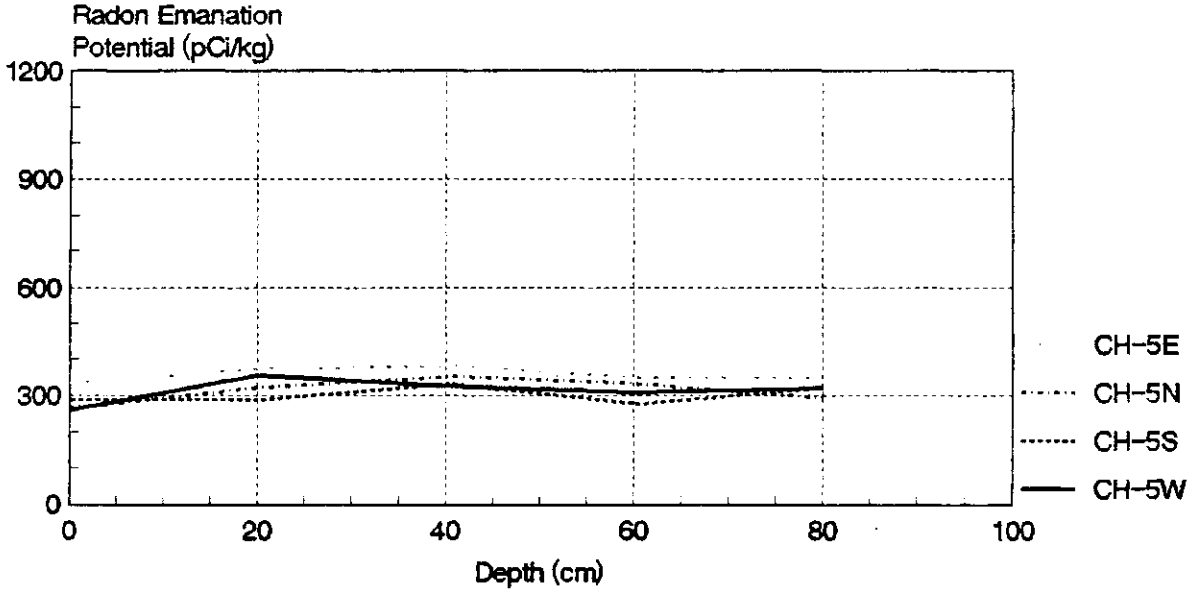
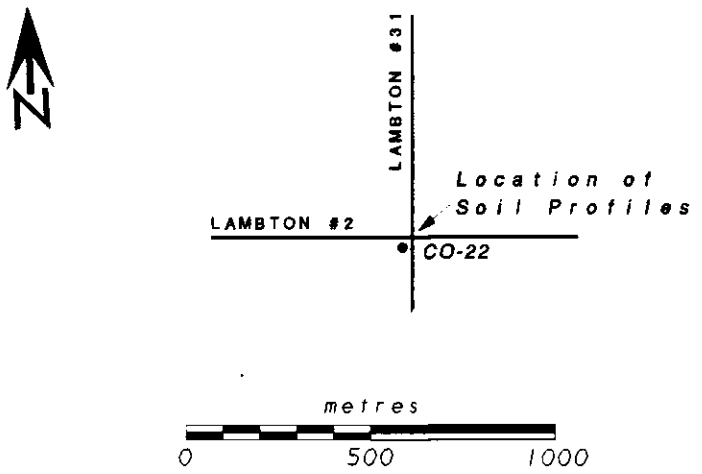
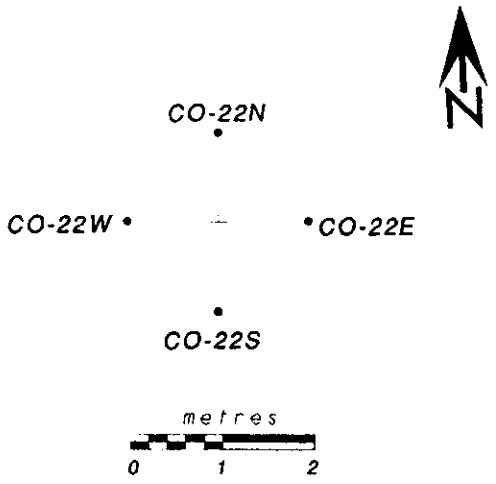


Figure P-16
Chatham Gas: Profiles - Station CH-5
Radon Emanation Potential Results

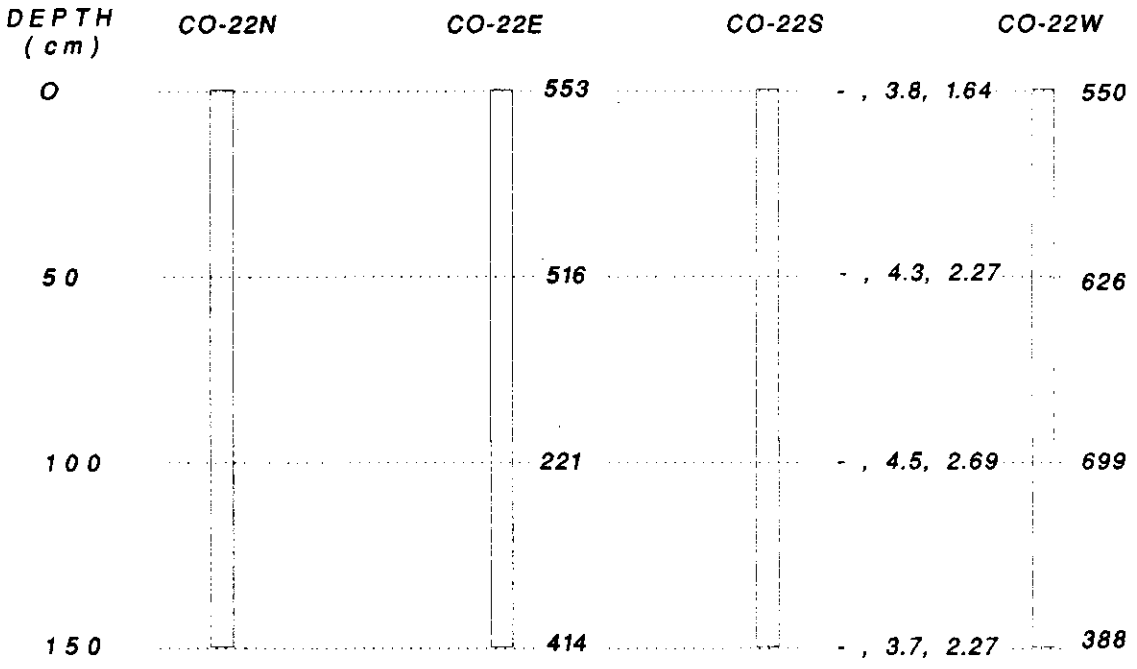




LOCATION MAP



DETAIL PLAN



RESULTS: 454,1.8,3.00 - EMANATION POTENTIAL (pCi/kg), URANIUM (ppm), RADIUM (pCi/g)

PROFILES

ONTARIO GEOLOGICAL SURVEY

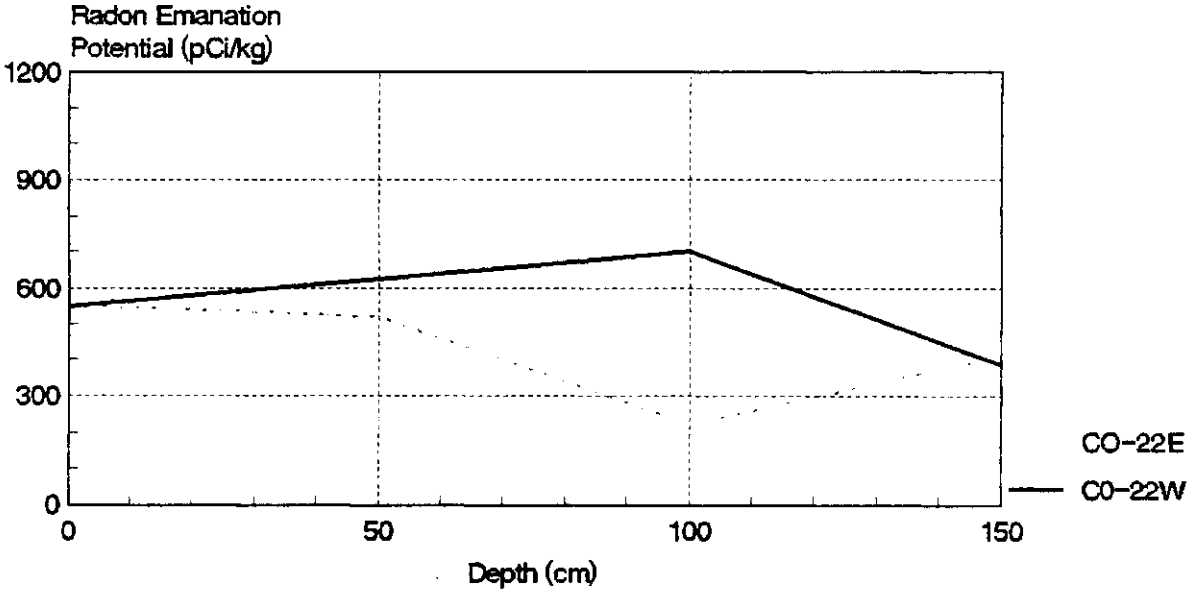
RADON HYDROCARBON EXPLORATION STUDY

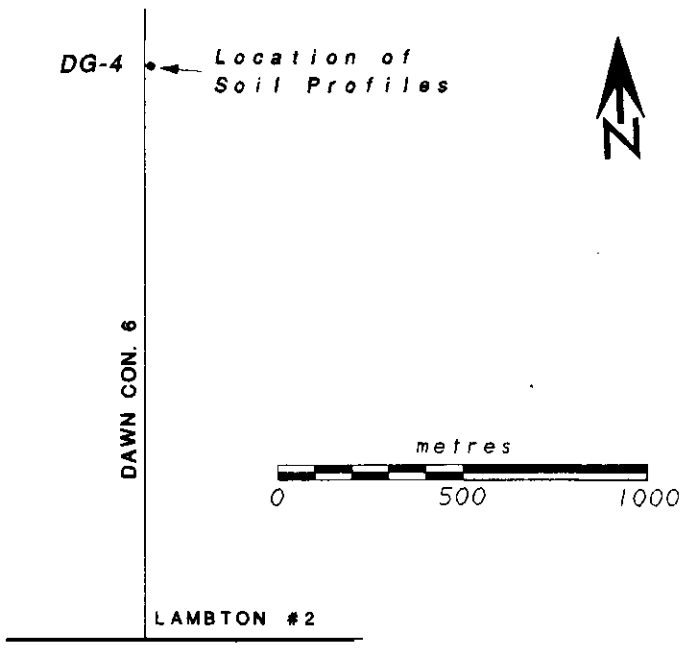
COVENY GAS FIELD

SOIL PROFILE RESULTS - STATION CO-22

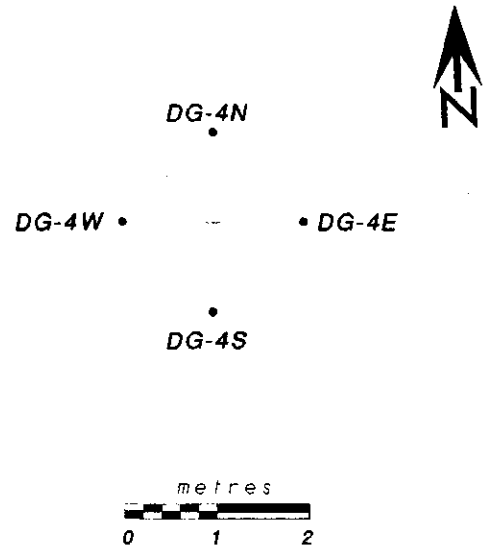
Figure P-17

Figure P-18
Coveny Gas: Profiles - Station CO-22
Radon Emanation Potential Results

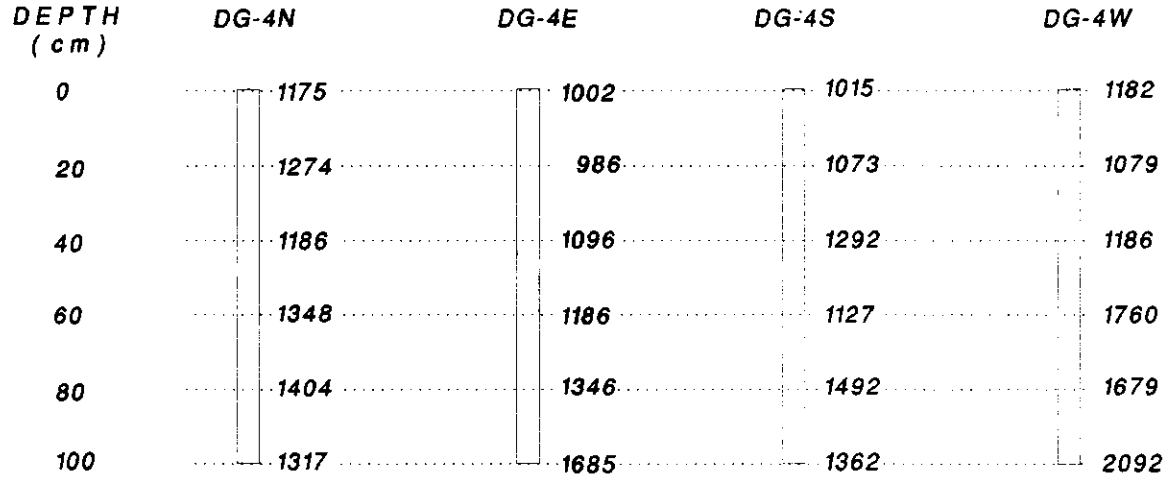




LOCATION MAP



DETAIL PLAN



RESULTS: 454 - EMANATION POTENTIAL (pCi/kg)

PROFILES

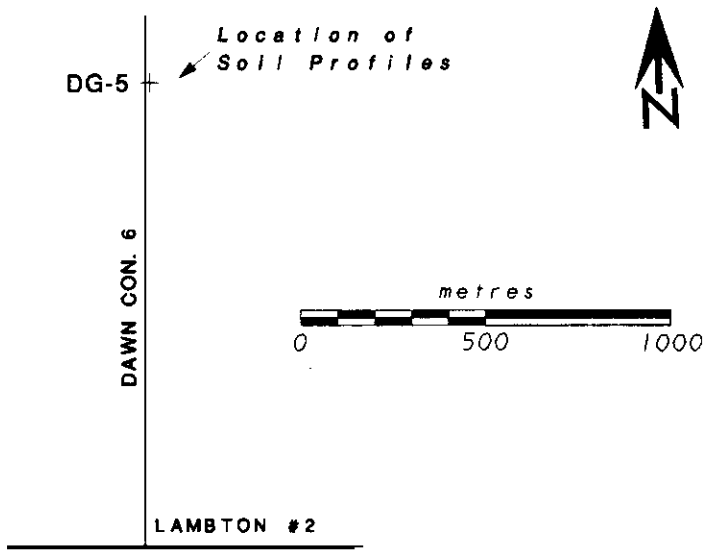
ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

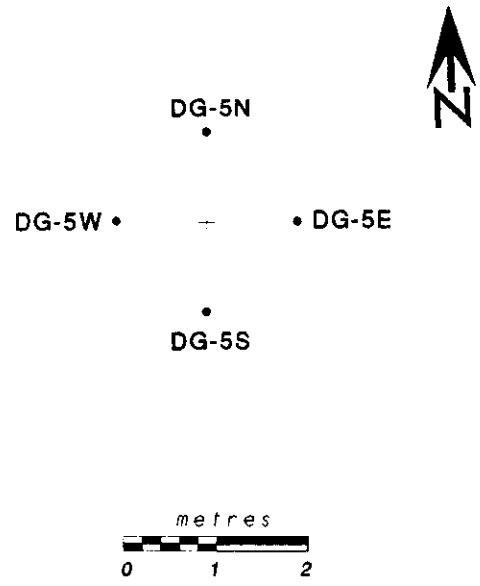
DAWN GAS FIELD

SOIL PROFILE RESULTS - STATION DG-4

Figure P-19



LOCATION MAP



DETAIL PLAN

DEPTH (cm)	DG-5N	DG-5E	DG-5S	DG-5W
0	905, 8.5, 3.13	1065, 10.6	1022, 9.7, 3.45	1009, 8.6
20	1055, 9.2, 3.45	1098, 10.7	987, 11.0, 3.24	1039, 12.1
40	1111, 9.6, 3.85	1062, 10.9	1105, 9.4, 3.87	1026, 11.9
60	1413, 9.4, 2.83	1430, 12.5	1274, 10.1, 4.25	1169, 11.2
80	1261, 9.5, 3.80	1371, 11.5	1161, 8.9, 4.18	1393, 12.1
100	1290, 1.9, 3.36	1386, 10.4	1257, 8.2, 4.10	1528, 10.6

RESULTS: 454,1.8,3.00 - EMANATION POTENTIAL (pCi/kg), URANIUM (ppm), RADIUM (pCi/g)

PROFILES

ONTARIO GEOLOGICAL SURVEY

RADON HYDROCARBON EXPLORATION STUDY

DAWN GAS FIELD

SOIL PROFILE RESULTS - STATION DG-5

FIGURE P-20

Figure P-21
Dawn Gas Field: Profiles - Station DG-4
Radon Emanation Potential Results

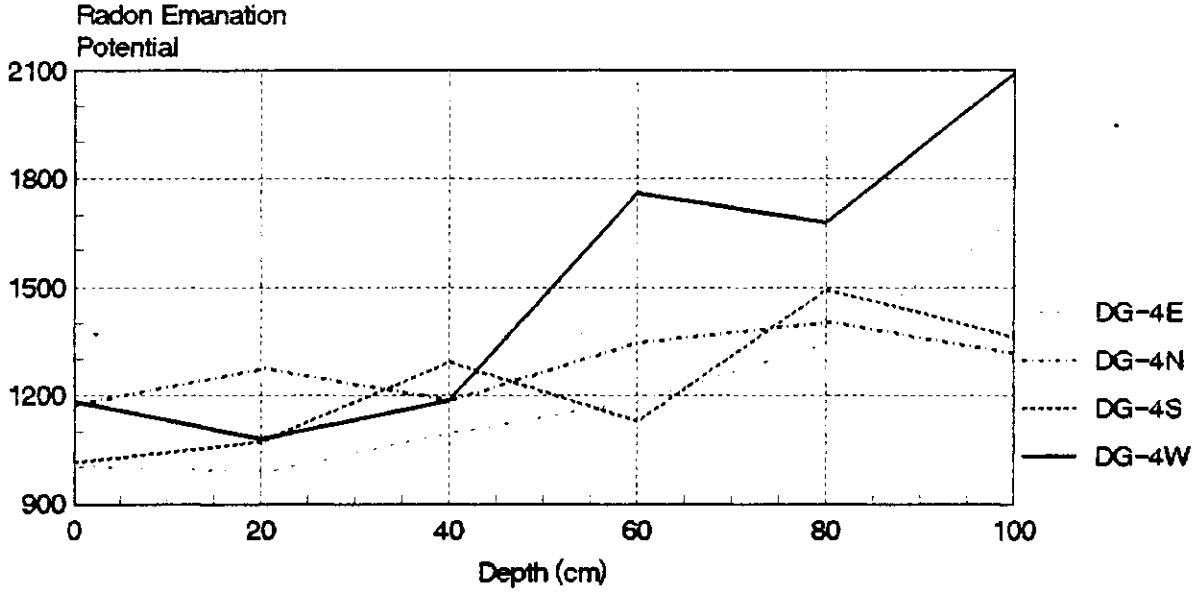


Figure P-22
Dawn Gas Field: Profiles - Station DG-5
Radon Emanation Potential Results

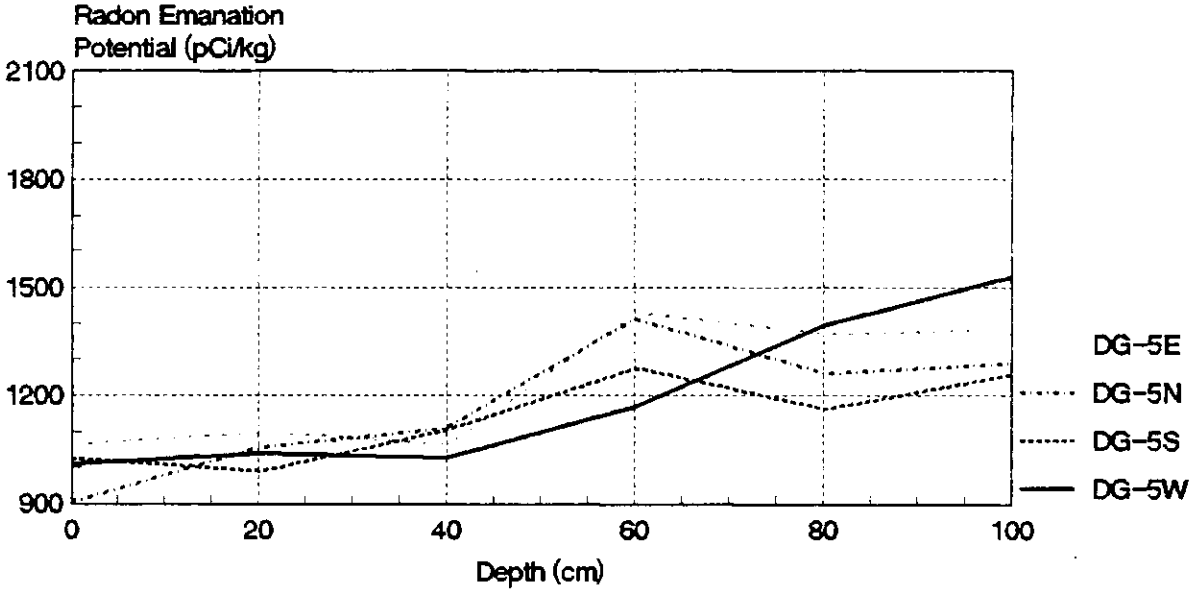


Figure P-23
Dawn Gas Field: Profiles - Station DG-5
Radium Results

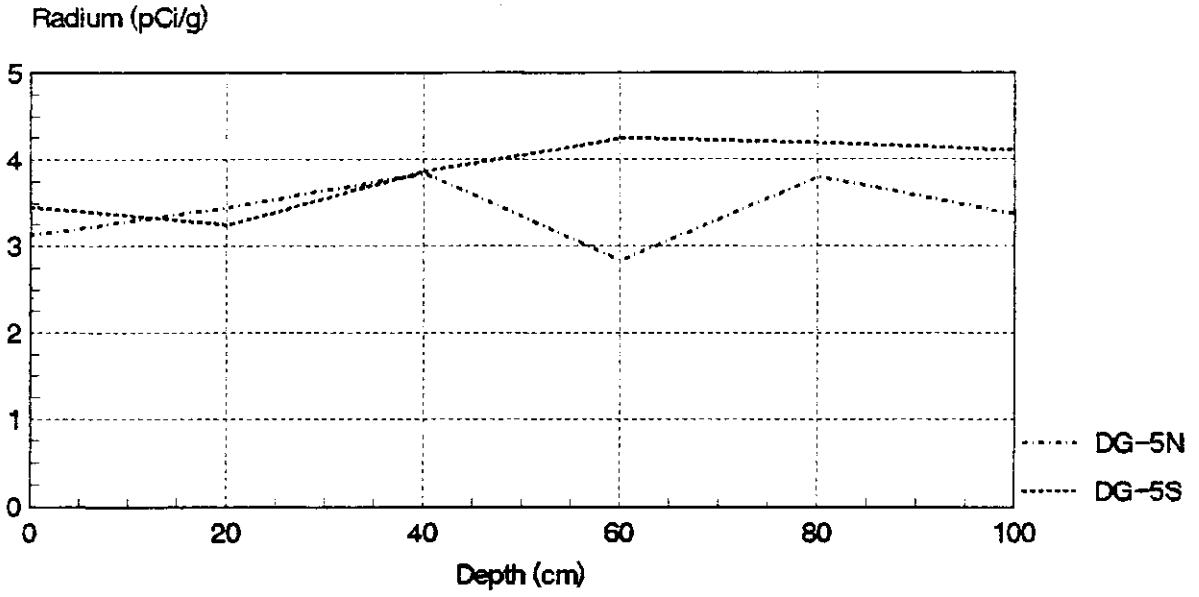


Figure P-24
Dawn Gas Field: Profiles - Station DG-5
Uranium Results

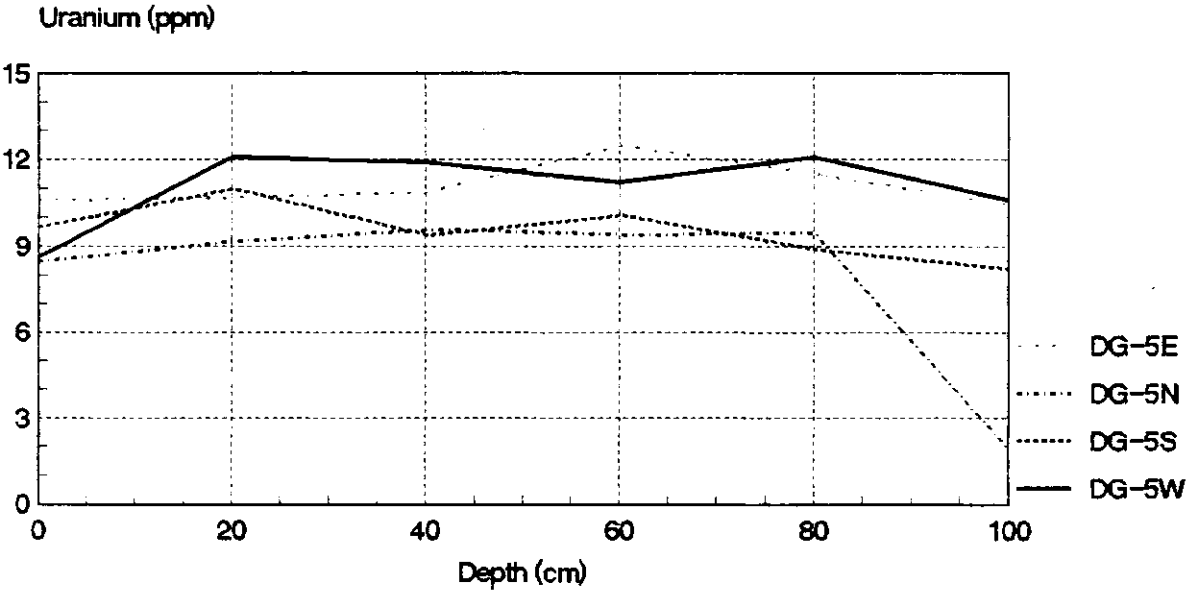


Figure P-25
Dawn Gas Field: Profile DG-5N: Uranium
Radium and Emanation Potential Results

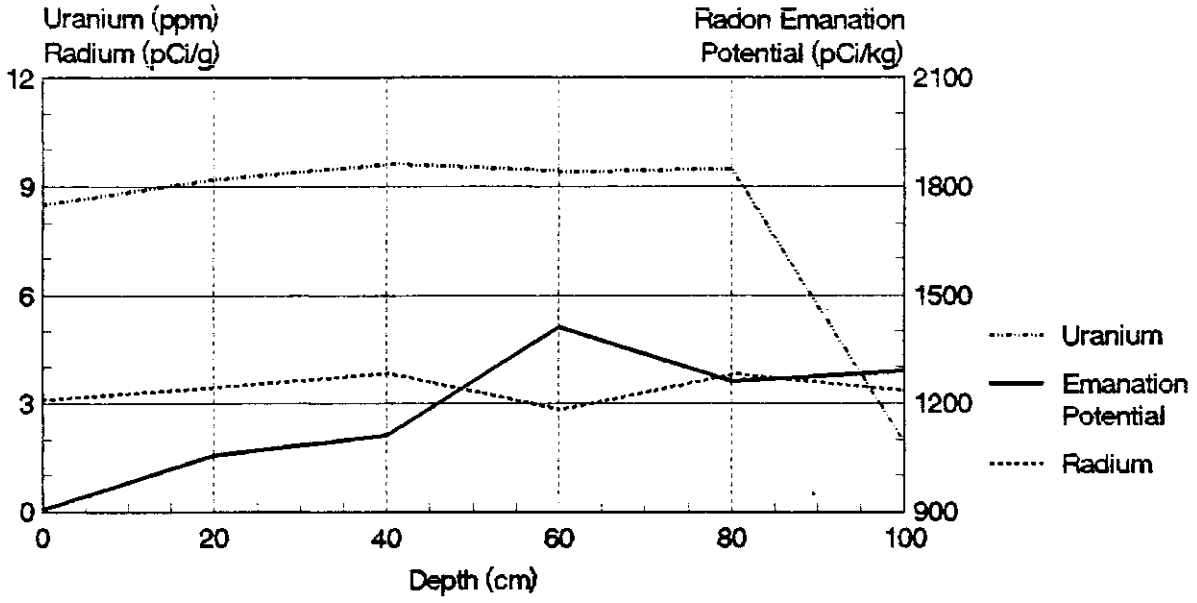
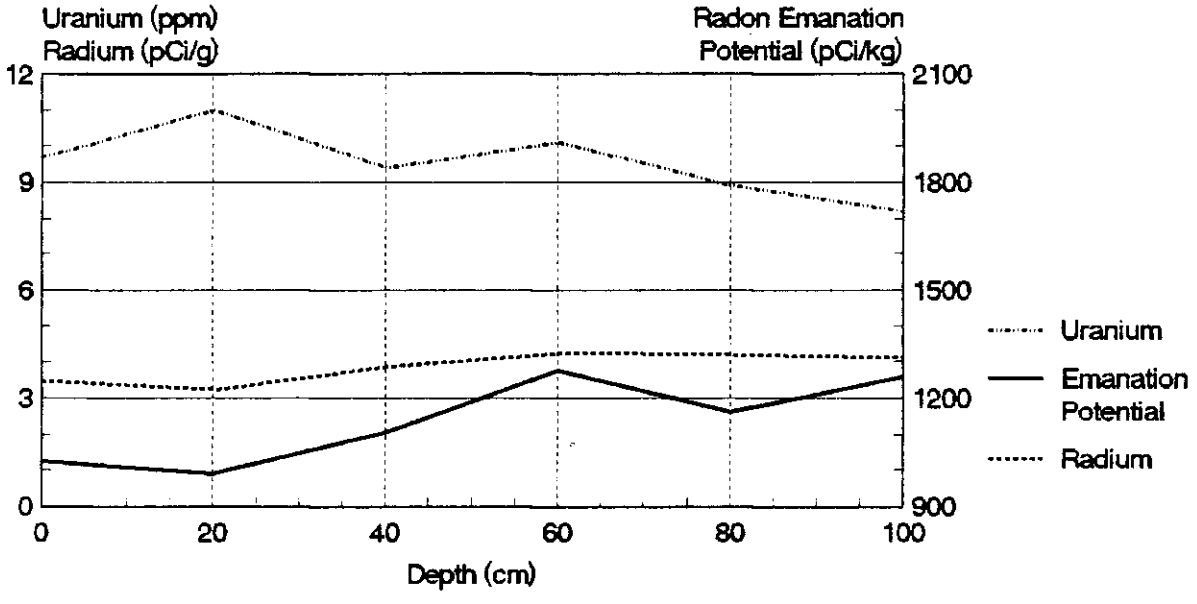
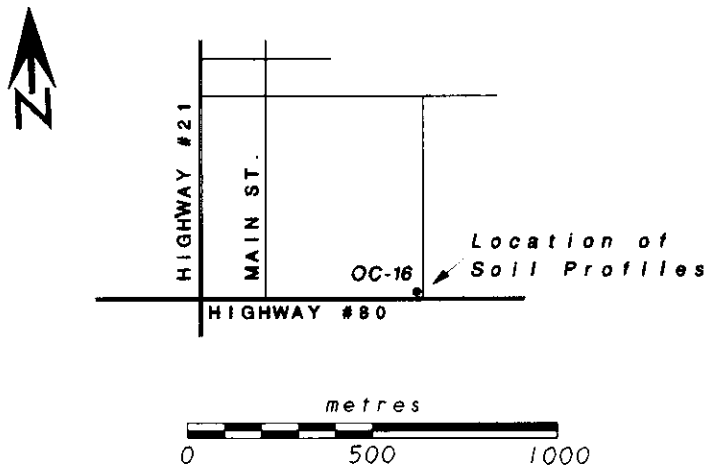
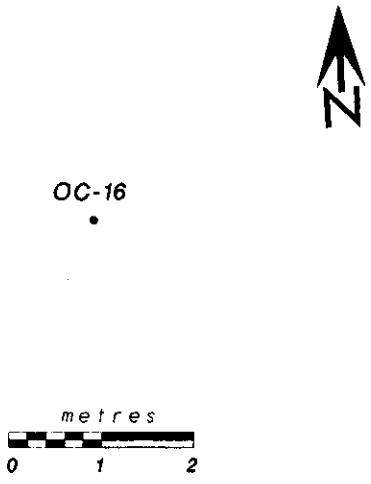


Figure P-26
Dawn Gas Field: Profile DG-5S: Uranium,
Radium and Emanation Potential Results

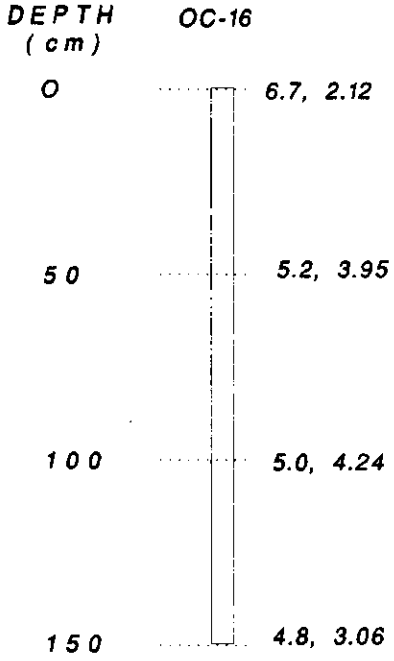




LOCATION MAP



DETAIL PLAN



RESULTS: 1.8,3.00 - URANIUM (ppm), RADIUM (pCi/g)

PROFILE

ONTARIO GEOLOGICAL SURVEY

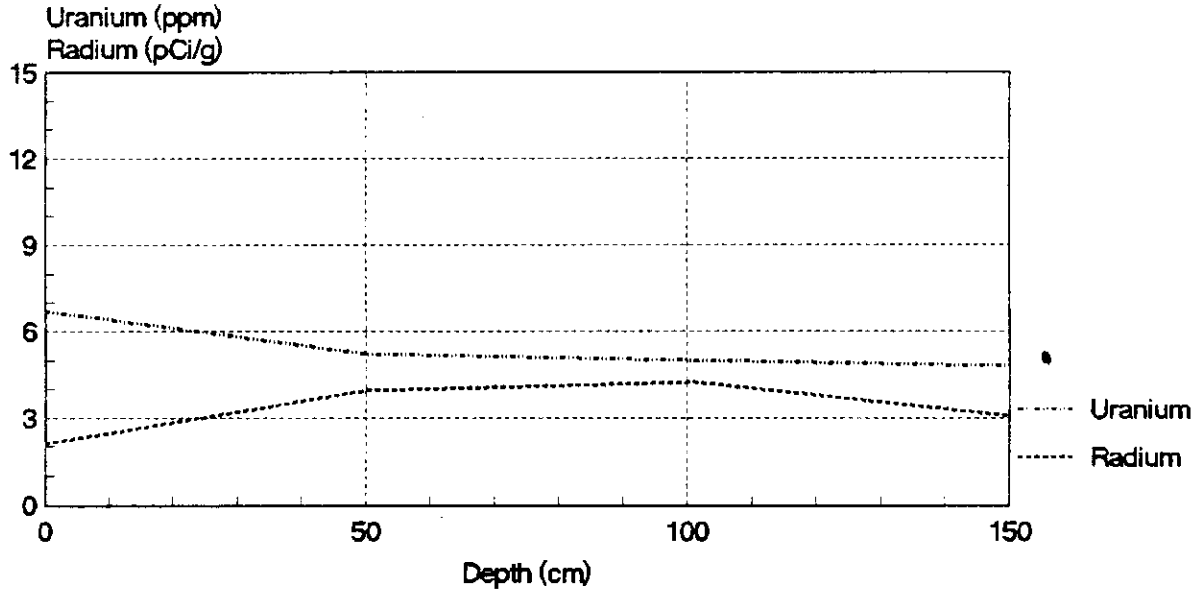
RADON HYDROCARBON EXPLORATION STUDY

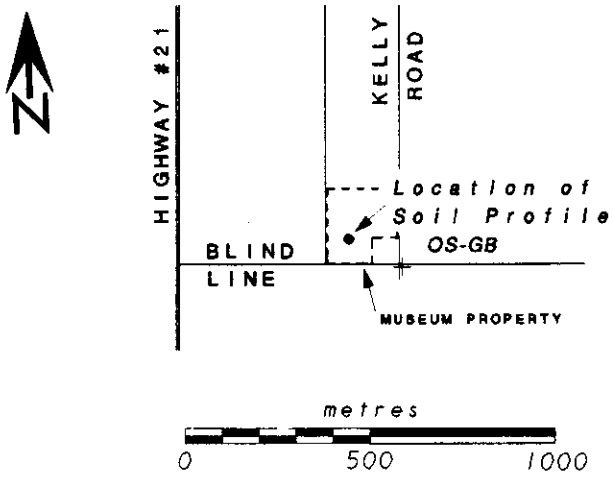
OIL CITY GAS FIELD

SOIL PROFILE RESULTS - STATION OC-16

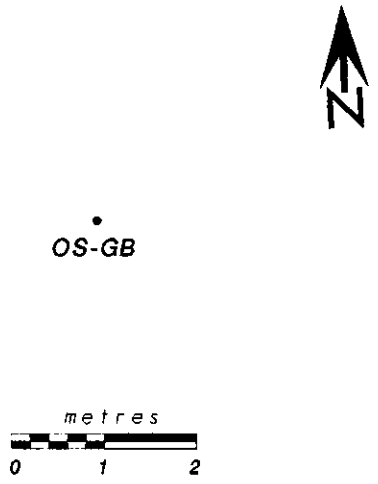
Figure P-27

Figure P-28
Oil City Gas Field: Profile OC-16
Uranium and Radium Results

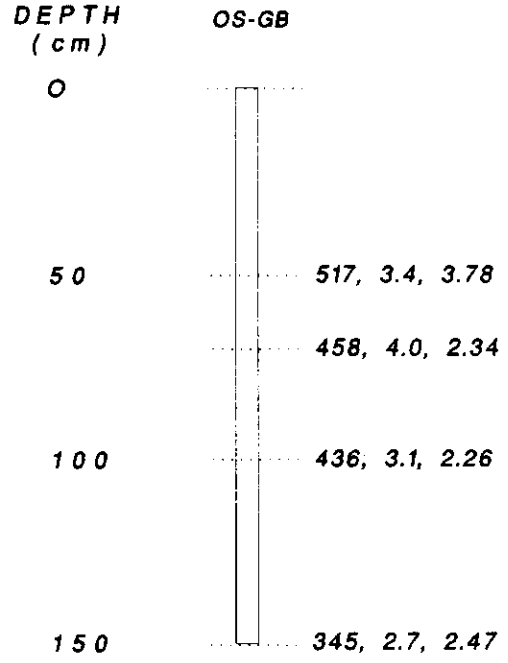




LOCATION MAP



DETAIL PLAN



RESULTS: 454,1.8,3.00 - EMANATION POTENTIAL (pCi/kg), URANIUM (ppm), RADIUM (pCi/g)

PROFILE

ONTARIO GEOLOGICAL SURVEY

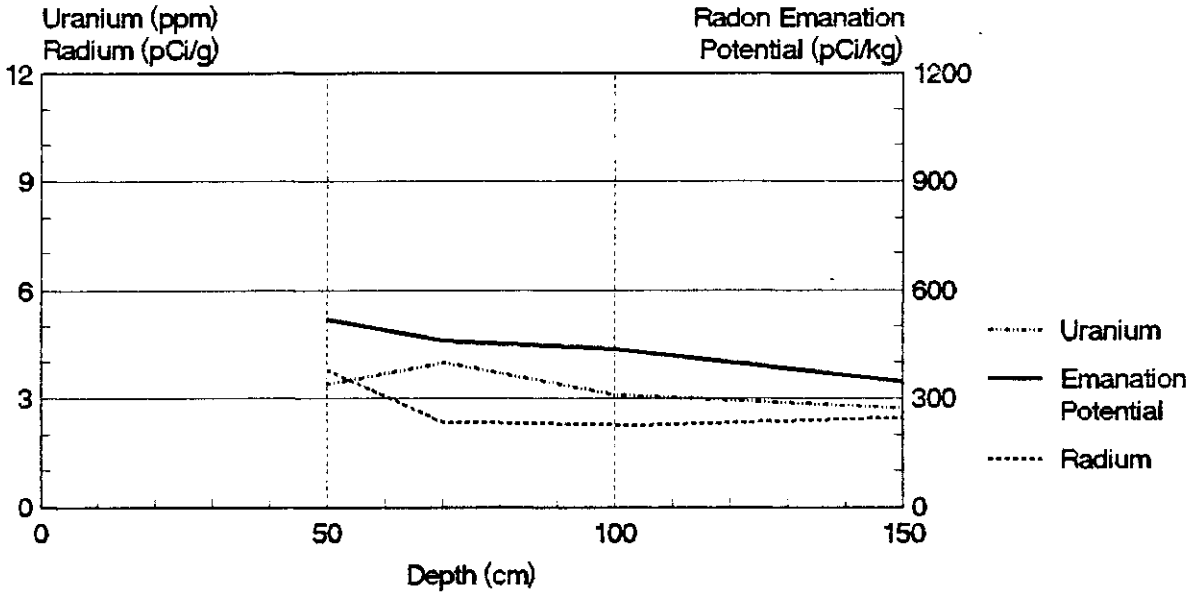
RADON HYDROCARBON EXPLORATION STUDY

OIL SPRINGS AREA

SOIL PROFILE RESULTS - STATION OS-GB

Figure P-29

Figure P–30
Oil Springs: Profile OS–GB: Uranium,
Radium and Emanation Potential Results



DISCUSSION OF RESULTS

During review of assay data for apparent radium, radium, and uranium, it must be recognized that the probability of repeating any assay within $\pm$ 10% is generally low. Each assay is a valid member of a distribution, but there will always be some variation about the mean. Therefore adjacent samples, or replicate samples should not be expected to give identical values.

Correlation of uranium, radium, and apparent radium values are relatively good. However, correlation of soil gas radon values with the soil apparent radium sample values are not. This is interpreted to be caused by variation in soil gas radon concentrations due to variable moisture content of the soils surrounding the soil gas radon detectors, and also to the influence of radium concentrations at some depth below the detector.

The soil gas radon results obtained during this study are strongly influenced by high moisture content of the soils that resulted from frequent heavy rains that occurred during the study period. These conditions depressed radon concentrations so that they did not reflect directly the influence of radium in the soil surrounding the detectors.

Radon in soil gas surveys are subject to many influences, chief of which is moisture content of the soil. Soil sampling surveys and analyses for radium, either total or apparent radium, must take the vertical geochemical distribution of the metal in the soil into account. The level in the soil where radium tends to concentrate is apparently at the average water table. This horizon, in the areas studied, varies in depth from less than 1 to 5 m or more.

Effective radium geochemistry surveys must recover soil samples from the level at which concentration takes place. This is the most serious problem with this approach. Soil samples can be recovered from depths of less than 1.5 m quite easily. At greater depths the time and effort required increase, and productivity falls. In addition, orientation surveys are required to determine the position

of the most favourable horizon. This adds another step and additional cost to the survey, and interpretation of results, although entirely possible, is complicated by the additional information necessary. Interpretation risks include working with field data that are not sufficiently precise or incomplete, undetected local variations in soil formation, water table level, et cetera. All these are manageable. However, exploration geochemistry for any element or commodity should be as simple and straight forward as possible so that sample collection, treatment, and interpretation of results can be done by reasonably competent technicians. The results of these studies suggests that soil sampling for radium related to petroleum accumulations requires the services of an experienced exploration geochemist.

Soil gas radon surveying during average summer weather is usually not subject to severe complicating influences. The detectors can be placed and read by technicians and the results interpreted with a minimum of difficulty. The extra handling necessary contributes to a slightly higher cost than are associated with a soil sampling survey, but the ease of interpretation tends to offset this disadvantage. Serious survey and interpretation risks are limited mostly to changing moisture content of the soil caused by heavy rains, and the relatively short season during which these surveys can be done effectively.

GENERAL CONCLUSIONS

1. The soils of the study areas were very damp to saturated during the soil gas surveys. Consequently, the radon concentrations recorded were less than those obtained during the drier weather experienced during the 1991 surveys (Tilsey et al. 1993). However, in most cases there is contrast across most known oil and gas pools, particularly related to known or interpreted faults, and along the limits of traps.

2. There appears to be a reasonable correlation (0.85) between radium, apparent radium, and uranium content of the soils studied during the 1992 surveys.

3. Study of the 1992 survey data indicate a very poor over-all correlation of ~0.2 between apparent radium at in soils and radon in soil gas, and the sample-to-sample correlation is also generally poor. Correlations would likely be better in drier weather, when soil gas radon results are observed to be much more consistent. For example, results from the Coveny Field where soils along major ditches were relatively well drained showed good (0.67) general correlation.

4. The contrast between radium values from soil samples taken at ~40 cm depth (both apparent radium and radium values from gamma ray spectrometer determinations) across a petroleum-bearing structure is generally less than 3 times. This low "signal to noise" ratio makes interpretation of these data somewhat problematic due to the subtle nature of anomalies.

5. Results of analyses of soil sample vertical profiles indicate an enrichment of radium usually between 0.60 m and 0.80 m below surface in the poorly drained, heavy clay soils that are developed in much of southwestern Ontario. Soil gas radon values appear to respond to the average radium content of the soil within the contribution range of the sample, and the influence of an increased radium content at depth may be responsible for elevated soil gas radon values not suggested by the radium content of soil samples taken at 30 to 45 cm below surface.

6. Soil gas radon measurements during dry weather appear to be well suited to exploration for oil and natural gas since contrast is high (up to 10X), the signal to noise ratio is large, and the size of effective sample is large enough to "average out" much of the variation observed in results of uranium assays, radium assays and apparent radium assays.

7. The variability observed in results of soil geochemical techniques applied during this study appear to relate, in part, to sample size. The small quantities treated (~1 g for uranium assay and ~30 g for radon emanation potential "apparent radium') may cause "noise" in the data base because of variation due to what might be called a "nugget effect".

8. It also appears that the level at which radium concentrates in the soil is often deeper than can be soil sampled easily, apparently being greatest near the top of the "average" water table. This concentration may be "seen" by radon detectors placed in the soil since radon can migrate in the soil gas toward surface for approximately 2 to 3 m before disapearing due to radiogenic decay.

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APPENDIX I

Sampling, Assaying,

Calculations, Glossary

SAMPLING DATA

The radon measuring system used during the Soil Radon Gas Study of southern Ontario has been described at length in the body of the report. The data collection and processing routines are discussed in some detail in the following pages.

The detector uses the surface voltage drop on an electret which has been given an initial quasi-permanent voltage charge in the order of 700 to 750 volts, as a measure of the radon concentration.

Ions are formed within the ion chamber when radon disintegrates spontaneously. The ions are attracted to the electret and reduce the voltage as they collect on the surface of the electret.

The sensitivity of electrets is controlled by the manufacturing process, and each type (short term, long term, et cetera) responds differently, but predictably, to the number of ionizing events.

The reading procedure is simple. The voltage on the electret is measured when the detector is installed, and again after the period of exposure. The following information is recorded.

1. date and time of deployment
2. initial voltage
3. date and time of reading
3. voltage at time of reading

This information allows calculation of exposure time and voltage drop.

In simple terms, the calculation involves determining the voltage drop per time period (volts per day) and computing the radon concentration by applying a "pCi/L per volt" factor.

The actual calculation is slightly more involved: A calibration factor is computed using the mid-point of the voltage spread and constants supplied by the manufacturer (derivation of the constants is

discussed by Kotrappa et al. (1988, 1990).

EXAMPLE:

The following calculation assumes use of an "L"-type ion chamber of 50 mL and a red label long term electret. Exposure has been 90 days and 8 hours. Gamma dose is 10 uR/h.

Assume an initial voltage of 700 V (V1)and a final voltage of 650 V (V2).

Step 1. Calculate the calibration factor.

CF = 0.02723 + (0.000012795*((700 + 650)/2) = 0.035866

Step 2. Calculate the radon concentration.

Rn = ((V1-V2)/(Cal. Factor * Time in days)/2 - (Gamma dose * Gamma dose factor for 50 mL ion Chamber)]

Rn = ((700-650)/(0.035866*90.33)) - (10*0.12) = 14.233 pCi/L.

NOTE:

These calculations are specifically for the 50 mL ion chamber and the red label long term electret exposed in a gamma dose environment of 10uR/h. Other chambers and gamma backgrounds will use other specific factors.

RAW DATA

Time and voltage data shown on the first spread sheet in the following Appendices observe these conventions:

1. Days are calendar days from January 1.
2. Time is given in 24 hour format plus elapsed minutes.

(This precision is not required but is convenient for field purposes; the nearest hour is more

than adequate)

3. Voltage: V(i) is initial voltage; V(2), is voltage after first exposure period, V(3) is voltage after the second period, et cetera.

SPREAD SHEETS

The first spread sheet following the raw data gives calculated average radon concentrations from the time of initial emplacement.

The third spread sheet shows the average radon concentration for each measurement period.

SYMBOLS

In some cases, the original electret was discharged to the point that it had to be replaced. The following code is used to signify electret replacement:

#	first replacement
@	second replacement
!	third replacement
!!	fourth replacement

Doubled detectors at any sample site will show a lower case "d" after the sample number: e.g. CA2-29d.

Sample numbers followed by a "*" indicate tampering at some time during deployment, e.g. CO-15*. Sample sites from which detector packages were stolen are noted on the data sheets.

RADON EMANATION POTENTIAL OF SOILS

The quantity of radon emitted by a soil is known as its **radon emanation potential.** This is a function of the radium content and the location of the radium atoms within or adsorbed on the minerals that make up the soil. The radon emanation potential of soils at a particular site is important in estimating the quantity of radon that is present.

The amount of radon that is generated in any (geologic) material is a function of the radium (Ra^{226}) content of the material and the equilibrium state of the radium. In most cases, Rn^{222} and its parent Ra^{226} are in secular equilibrium, that is, one gram of radium will produce 3.7×10^{10} radon atoms per second.

Only the radon that is released from the soil-forming minerals is considered in this context. Radon that does not escape from the soil minerals is not included.

The radon emanation potential of a soil or other material can be determined by sealing a known weight in a container of known volume and measuring the radon concentration of the air in the container for a period of at least 15 to 20 days, longer periods give slightly more accurate results due to larger detector voltage drop and the Rn concentration approaching equilibrium with its parent Ra^{226}.

The radon emanation potential is reported in pCi/g.

The radon detector used in this study is manufactured by Rad Elec Inc. of Frederick, Maryland, U.S.A., and sold under the trade name E-PERM. The detector uses a piece of dielectric material which has been given a quasi-permanent electrical charge. This "electret" produces a strong electrostatic field which collects ions of opposite sign. When exposed in an ion chamber to which air is admitted through a filtered opening, ions resulting from spontaneous decay of radon are collected on the electret and cause a drop in surface voltage. Voltage on the electret is read in a special surface voltage meter before and after exposure, and the voltage change is recorded. The voltage drop is converted by calculation to radon

concentration by a simple formula which considers the sensitivity of the electret, volume of the ion chamber, voltage drop, exposure time, correction for the influence of gamma radiation, et cetera.

The Radon Emanation Potential is calculated from the Rn concentration in the flask, corrected for degree of equilibrium which is a function of time, and the effect of ambient laboratory gamma radiation, then normalized to pCi/g of sample on the basis of actual sample weight.

$$\text{Radon Emanation Potential} = \frac{(4 \times (R/G))}{\left(1 - \frac{1 - e^{(-0.1813 \times T)}}{0.1813 \times T}\right)}$$

Where:

4 = Flask volume in liters
R = Measured Rn concentration in pCi/L
G = Weight of sample in grams
T = Time of exposure in days
0.1813 = equilibrium constant
e = 2.7183

The precision of the method depends on the total voltage drop, mainly because the voltage meters can be read only to the nearest volt. In addition, the distance from the electret to the voltage sensor may be slightly variable and small voltage differences can occur because of problems of mechanical alignment. We have found that determinations are subject to measurement error of about ± 2 to ± 3 volts. If the voltage drop is 100V, this is $\pm 2\%$ to $\pm 3\%$. But, if the voltage drop is only 25V, the measurement error is $\pm 8\%$ to $\pm 12\%$.

However, experience with the method, which includes measurements of radon concentration by series of duplicate detectors, shows the overall correlation is better than 0.95, usually in the range of 0.97 to 0.99.

Sample numbers with following letters have the following meanings:

DO-12AD	sample was air dried
DO-12ADL	sample was air dried in lumps as received
DO-12DL	sample was oven dried in lumps as received
OC-20B	replicate sample
CLE-1	Clearville soil sample line, soil gas sampling not possible due to flooded soil conditions

NOTE: All regular samples for radon emanation potential (apparent radium) analyses were oven dried at 225 degrees F. (107°C). Clay samples were shaved into 1mm thick chips for consistency. Sandy soils were crumbled to ~1mm so that no large lumps remained.

GLOSSARY

Becquerel Unit of radioactive decay; 1 disintegration per second.

Becquerel per cubic meter 1 disintegration per second per cubic meter of air, ...

Bq/m^3 Becquerel per cubic meter.

Curie 3.70×10^{10} disintegrations per second. (approximately the activity of one gram of radium)

1 pico Curie 10^{-12} Curie; 0.037 disintegrations per second, or 2.22 disintegrations per minute.

1 pico Curie per litre 0.037 disintegrations per second per litre of air, water, ...

pCi/L pico Curie per litre.

Electret A disc carrying a quasi-permanent surface voltage.

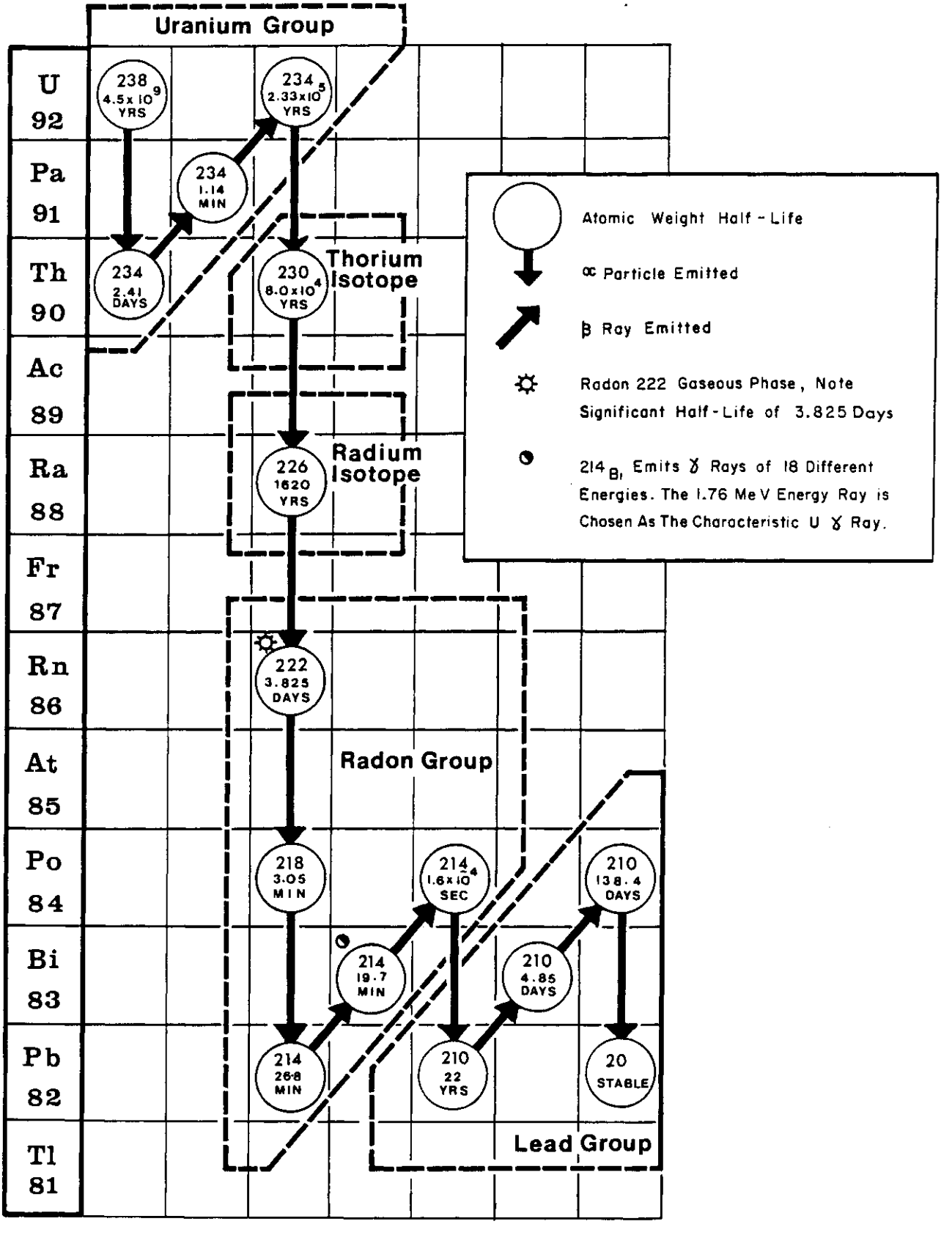
Half-life The time required for a radioactive element to decay to 1/2 its original concentration. e.g. 100 radon atoms at T_1 will have decayed to 50 atoms at T_2 which is 3.825 days later.

Roentgen That quantity of gamma radiation that produces in 1mL of dry air at 0^0 and 760 mm Hg, ions carrying 1 statcoulomb of electricity of either sign.

uR 10^{-6} Roentgen.

uR/h 10^{-6} Roentgen per hour.

NATURAL RADIOACTIVE SERIES URANIUM 238



APPENDIX II

Soil Gas Radon
Raw Data & Calculations

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

CONTROL AREA #1 RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V (i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
CA1-1	LC 8288	303	9	7	376	310	9	33	342	333	10	18	233
CA1-2	LC 5431	303	9	27	331	310	9	28	306	333	10	15	159
CA1-3	LB 5521	303	9	40	382	310	9	24	316	333	10	13	217
CA1-4	LC 5675	303	9	50	373	310	9	21	350	333	10	10	288
CA1-5	LB 6431	303	9	55	306	310	9	18	278	333	10	7	247
CA1-6	LC 5625	303	10	5	336	310	9	14	305	333	10	5	239
CA1-7	LC 2948	303	10	20	395	310	9	11	381	333	10	1	252
CA1-8	LC 5473	303	10	25	313	310	9	9	280	333	9	58	105
CA1-9	LC 5359	303	10	35	368	310	9	7	320	333	9	57	221
CA1-10	LC 5619	303	10	40	346	310	9	5	328	333	9	55	258
CA1-11	LC 5715	311	7	50	383	317	9	55	365	333	9	52	313
CA1-12	LC 4174	303	11	5	387	310	8	57	341	333	9	50	134
CA1-13	LB 5226	311	7	55	325	317	9	58	308	333	9	48	256
CA1-14	LC 5695	303	11	25	392	310	8	53	375	333	9	45	332
CA1-15	LB 5674	303	11	30	351	310	8	49	320				
CA1-16	LC 4311	303	11	40	362	310	8	45	341	333	9	38	295
CA1-17	LC 5605	303	12	15	368	310	10	8	349	333	10	55	284
CA1-18	LC 3628	303	12	20	312	310	10	6	284	333	10	52	210
CA1-19	LC 3634	303	12	25	336	310	10	2	297	333	10	50	224
CA1-20	LC 5656	303	12	35	347	310	9	58	324	333	10	47	282
CA1-21	LB 4511	303	12	55	365	310	9	55	341	333	10	45	309
CA1-22	LC 3669	303	13	5	320	310	9	52	309	333	10	41	284
CA1-23	LC 5426	303	13	20	337	310	9	50	326	333	10	37	282
CA1-24	LC 2994	311	8	0	322	317	9	45	310				
CA1-25	LC 8374	303	13	45	316	310	9	40	298	333	10	27	235
CA1-26	LC 4203	303	14	5	388	310	10	15	376	333	10	58	290
CA1-27	LB 8266	303	14	10	389	310	10	16	367	333	11	2	295
CA1-28	LB 4153	303	14	20	385	310	10	20	358	333	11	5	310
CA1-29	LB 4394	303	14	30	345	310	10	23	302	333	11	7	243
CA1-30	LC 5247	303	14	45	391	310	10	30	356	333	11	10	288

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #1

RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA1-1	149.94	7.02	150.59	30.05
CA1-2	111.78	7.00	186.31	30.03
CA1-3	295.65	6.99	174.63	30.02
CA1-4	101.15	6.98	87.73	30.01
CA1-5	127.35	6.97	61.61	30.01
CA1-6	139.77	6.96	102.31	30.00
CA1-7	60.26	6.95	149.73	29.99
CA1-8	150.82	6.95	229.70	29.98
CA1-9	216.40	6.94	155.92	29.97
CA1-10	80.00	6.93	92.14	29.97
CA1-11	90.07	6.09	97.75	22.08
CA1-12	206.44	6.91	274.12	29.95
CA1-13	87.01	6.09	98.69	22.08
CA1-14	74.43	6.89	60.62	29.93
CA1-15	140.47	6.89		
CA1-16	93.93	6.88	68.96	29.92
CA1-17	84.10	6.91	87.04	29.94
CA1-18	128.29	6.91	109.15	29.94
CA1-19	178.38	6.90	119.13	29.93
CA1-20	103.59	6.89	67.20	29.93
CA1-21	107.67	6.88	57.06	29.91
CA1-22	48.97	6.87	36.43	29.90
CA1-23	48.70	6.85	56.71	29.89
CA1-24	60.89	6.07		
CA1-25	82.29	6.83	85.90	29.86
CA1-26	52.33	6.84	101.64	29.87
CA1-27	98.04	6.84	97.28	29.87
CA1-28	121.24	6.83	76.99	29.86
CA1-29	198.45	6.83	107.93	29.86
CA1-30	157.97	6.82	106.99	29.85

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #1 (Incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA1-1	149.94	7.02	150.82	23.03
CA1-2	111.78	7.00	209.00	23.03
CA1-3	295.65	6.99	137.98	23.03
CA1-4	101.15	6.98	83.67	23.03
CA1-5	127.35	6.97	41.70	23.03
CA1-6	139.77	6.96	91.00	23.04
CA1-7	60.26	6.95	176.74	23.03
CA1-8	150.82	6.95	253.57	23.03
CA1-9	216.40	6.94	137.74	23.03
CA1-10	80.00	6.93	95.80	23.03
CA1-11	90.07	6.09	100.67	16.00
CA1-12	206.44	6.91	294.57	23.04
CA1-13	87.01	6.09	103.14	15.99
CA1-14	74.43	6.89	56.49	23.04
CA1-15	140.47	6.89		
CA1-16	93.93	6.88	61.50	23.04
CA1-17	84.10	6.91	87.93	23.03
CA1-18	128.29	6.91	103.43	23.03
CA1-19	178.38	6.90	101.40	23.03
CA1-20	103.59	6.89	56.32	23.03
CA1-21	107.67	6.88	41.96	23.03
CA1-22	48.97	6.87	32.69	23.03
CA1-23	48.70	6.85	59.09	23.03
CA1-24	60.89	6.07		
CA1-25	82.29	6.83	86.98	23.03
CA1-26	52.33	6.84	116.29	23.03
CA1-27	98.04	6.84	97.06	23.03
CA1-28	121.24	6.83	63.86	23.03
CA1-29	198.45	6.83	81.11	23.03
CA1-30	157.97	6.82	91.90	23.03

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

CONTROL AREA #2 RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3
CA2-1	LB 4013	303	15	20	381	310	11	18	362	333	13	42	292
CA2-2	LC 8279	303	15	30	343	310	11	16	318	333	13	40	223
CA2-3	LC 3657	303	15	40	344	310	11	12	314	333	13	37	260
CA2-4	LC 8357	304	9	28	382	317	8	20	266				
CA2-4*	LC 2908	317	8	20	488	333	13	34	451				
CA2-5	LB 4689	304	9	25	366	310	11	2	321	333	13	30	248
CA2-6	LB 2916	304	9	35	339	310	10	59	279	333	13	27	221
CA2-7	LC 5312	304	9	40	380	317	8	25	272				
CA2-7*	LC 4136	317	8	25	471	333	13	23	394				
CA2-8	LC 4097	304	9	35	362	310	10	53	351	333	13	20	257
CA2-9	LC 8325	304	9	40	383	310	10	50	360	333	13	17	296
CA2-10	LC 2945	304	10	0	306	310	11	27	288	333	13	50	123
CA2-11	LC 5714	304	9	59	367	310	11	30	350	333	13	53	290
CA2-12	LC 5340	304	10	5	308	310	11	33	284	333	13	56	198
CA2-13	LC 4108	304	10	10	358	310	11	38	336	333	13	59	277
CA2-14	LC 4152	304	10	5	375	310	11	40	353	333	14	2	288
CA2-15	LC 5347	304	10	10	301	310	11	44	262	333	14	6	188
CA2-16	LC 5288	304	10	15	374	310	11	47	361	333	14	9	231
CA2-17	LC 5982	304	10	17	335	310	11	50	306	333	14	12	258
CA2-18	LC 8372	304	10	23	395	310	11	53	355	333	14	15	238
CA2-19	LC 5338	304	10	29	338	310	11	57	315	333	14	18	195
CA2-20	LC 1088	304	10	25	336	310	12	0	320	333	14	20	255
CA2-21	LC 5270	304	10	30	356	310	12	5	337	333	14	23	238
CA2-22	LC 4254	304	10	35	358	310	12	8	337	333	14	26	250
CA2-23	LC 5710	304	10	37	365	310	12	12	342	333	14	33	214
CA2-24	LC 5707	304	10	45	314	310	12	15	292	333	14	35	160
CA2-25	LC 5664	304	10	50	360	317	8	35	167				
CA2-25*	LC 5642	317	8	35	403	333	14	38	290				
CA2-26	LB 2715	304	10	45	374	310	12	27	351	333	14	41	317
CA2-27	LC 5505	304	10	50	344	310	12	28	321	333	14	42	249
CA2-28	LC 5646	304	10	55	340	310	12	31	327	333	14	46	275
CA2-29	LC 5244	304	10	56	373	310	12	35	327	333	14	48	203
CA2-30	LB 4308	304	11	5	349	310	12	38	313	333	14	51	218

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #2

RADON CONCENTRATION - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA2-1	84.66	6.83	91.99	29.93
CA2-2	114.17	6.82	127.69	29.92
CA2-3	137.74	6.81	88.01	29.91
CA2-4	283.14	12.95		
CA2-4*	66.34	16.22		
CA2-5	232.23	6.07	127.53	29.17
CA2-6	315.30	6.06	129.03	29.16
CA2-7	263.33	12.95		
CA2-7*	142.71	16.21		
CA2-8	54.86	6.05	113.17	29.16
CA2-9	116.60	6.05	92.23	29.15
CA2-10	93.42	6.06	207.07	29.16
CA2-11	85.83	6.06	81.70	29.16
CA2-12	125.36	6.06	121.52	29.16
CA2-13	112.31	6.06	86.48	29.16
CA2-14	111.44	6.07	92.49	29.16
CA2-15	206.26	6.07	125.33	29.16
CA2-16	64.84	6.06	155.37	29.16
CA2-17	150.33	6.06	82.81	29.16
CA2-18	203.71	6.06	169.83	29.16
CA2-19	118.53	6.06	157.76	29.16
CA2-20	81.63	6.07	87.27	29.16
CA2-21	96.63	6.07	128.11	29.16
CA2-22	107.02	6.06	116.72	29.16
CA2-23	117.11	6.07	165.08	29.16
CA2-24	114.36	6.06	172.22	29.16
CA2-25	486.37	12.91		
CA2-25*	217.29	16.25		
CA2-26	116.59	6.07	59.46	29.16
CA2-27	118.09	6.07	102.71	29.16
CA2-28	65.74	6.07	69.23	29.16
CA2-29	236.75	6.07	186.28	29.16
CA2-30	186.36	6.06	143.31	29.16

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #2 (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA2-1	84.66	6.83	94.17	23.10
CA2-2	114.17	6.82	131.70	23.10
CA2-3	137.74	6.81	73.35	23.10
CA2-4	283.14	12.95		
CA2-4*	66.34	16.22		
CA2-5	232.23	6.07	100.06	23.10
CA2-6	315.30	6.06	80.21	23.10
CA2-7	263.33	12.95		
CA2-7*	142.71	16.21		
CA2-8	54.86	6.05	128.45	23.10
CA2-9	116.60	6.05	85.86	23.10
CA2-10	93.42	6.06	236.93	23.10
CA2-11	85.83	6.06	80.63	23.10
CA2-12	125.36	6.06	120.52	23.10
CA2-13	112.31	6.06	79.70	23.10
CA2-14	111.44	6.07	87.52	23.10
CA2-15	206.26	6.07	104.11	23.10
CA2-16	64.84	6.06	179.15	23.10
CA2-17	150.33	6.06	65.09	23.10
CA2-18	203.71	6.06	160.97	23.10
CA2-19	118.53	6.06	168.08	23.10
CA2-20	81.63	6.07	88.75	23.10
CA2-21	96.63	6.07	136.39	23.10
CA2-22	107.02	6.06	119.28	23.10
CA2-23	117.11	6.07	177.70	23.10
CA2-24	114.36	6.06	187.43	23.10
CA2-25	486.37	12.91		
CA2-25*	217.29	16.25		
CA2-26	116.59	6.07	44.44	23.09
CA2-27	118.09	6.07	98.68	23.09
CA2-28	65.74	6.07	70.15	23.09
CA2-29	236.75	6.07	173.07	23.09
CA2-30	186.36	6.06	132.03	23.09

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

CONTROL AREA #3 RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
CA3-1	LC 5250	304	14	35	346	310	13	57	329	333	8	5	200
CA3-2	LC 8299	304	14	30	390	310	14	2	320	333	8	10	164
CA3-3	LC 5587	304	14	20	345	310	14	4	329	333	8	13	235
CA3-4	LC 4187	304	14	18	364	310	14	8	349	333	8	14	228
CA3-5	LC 5709	304	14	15	333	310	14	10	317	333	8	17	237
CA3-6	LC 2472	304	14	10	330	310	14	13	310	333	8	18	178
CA3-7	LC 4202	304	14	5	331	310	14	15	290	333	8	21	81
CA3-8	LC 5271	304	14	5	389	310	14	20	324	333	8	23	60
CA3-9	LC 2829	304	14	15	342	317	10	10	115				
CA3-9*	LC 5532	317	10	10	493	333	8	26	237				
CA3-10	LC 5599	304	14	20	379	310	14	27	332	333	8	27	81
CA3-11	LC 5616	304	14	25	325	317	10	15	153				
CA3-11*	LC 5639	317	10	15	454	333	8	31	235				
CA3-12	LC 3678	304	14	31	339	310	14	33	275	333	8	34	0
CA3-13	LB 2994	304	14	34	330	310	14	38	283	333	8	37	26
CA3-14	LC 5667	304	14	45	347	310	14	40	300	333	8	40	126
CA3-15	LC 4815	304	14	55	335	310	14	42	232	333	8	43	0
CA3-16	LC 3639	304	14	55	337	310	14	45	288	333	8	45	36
CA3-17	LC 4154	304	15	20	324	310	13	28	310	333	9	5	252
CA3-18	LC 5258	304	15	26	371	310	13	32	348	333	9	4	283
CA3-19	LB 3722	304	15	30	383	310	13	33	363	333	9	2	303
CA3-20	LC 3671	304	15	36	393	310	13	37	380	333	8	59	328
CA3-21	LC 5274	304	15	49	372	310	13	39	352	333	8	57	262
CA3-22	LC 5479	304	15	46	306	310	13	42	289	333	8	55	252
CA3-23	LC 6003	304	16	0	367	310	13	24	359	333	8	53	316
CA3-24	LC 5361	304	15	15	344	310	13	22	312	333	9	10	227
CA3-25	LC 6904	304	15	20	309	310	13	18	286	333	9	12	192
CA3-26	LC 8329	304	15	25	396	310	13	17	373	333	9	14	295
CA3-27	LC 1415	304	15	35	376	310	13	15	357	333	9	18	313
CA3-28	LC 4132	304	15	40	309	310	13	11	284	333	9	21	187
CA3-29	LC 8273	304	15	50	360	310	13	7	343	333	9	24	306
CA3-30	LB 3694	304	15	55	382	310	13	3	360	333	9	30	324
CA3-31	LB 4456	304	16	7	338	310	13	26	308	333	9	7	194

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #3

RADON CONCENTRATIONS - Averages
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA3-1	87.91	5.97	163.12	28.73
CA3-2	366.10	5.98	253.26	28.74
CA3-3	82.40	5.99	121.38	28.75
CA3-4	76.43	5.99	150.23	28.75
CA3-5	82.71	6.00	105.84	28.75
CA3-6	104.08	6.00	171.13	28.76
CA3-7	216.45	6.01	288.75	28.76
CA3-8	337.88	6.01	377.69	28.76
CA3-9	584.47	12.83		
CA3-9*	501.54	15.93		
CA3-10	244.00	6.00	341.17	28.75
CA3-11	440.45	12.83		
CA3-11*	432.30	15.93		
CA3-12	339.97	6.00	398.76	28.75
CA3-13	249.05	6.00	356.02	28.75
CA3-14	247.56	6.00	251.80	28.75
CA3-15	554.87	5.99	394.51	28.74
CA3-16	259.52	5.99	351.30	28.74
CA3-17	73.26	5.92	78.74	28.74
CA3-18	119.75	5.92	95.19	28.73
CA3-19	103.29	5.92	85.77	28.73
CA3-20	65.98	5.92	68.77	28.72
CA3-21	103.92	5.91	120.15	28.71
CA3-22	90.32	5.91	58.76	28.71
CA3-23	40.30	5.89	53.93	28.70
CA3-24	169.66	5.92	129.49	28.75
CA3-25	122.98	5.92	131.44	28.74
CA3-26	118.73	5.91	108.73	28.74
CA3-27	98.55	5.90	66.99	28.74
CA3-28	134.37	5.90	137.34	28.74
CA3-29	88.72	5.89	57.39	28.73
CA3-30	114.70	5.88	61.29	28.73
CA3-31	160.16	5.89	161.45	28.71

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CONTROL AREA #3 (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CA3-1	87.91	5.97	182.88	22.76
CA3-2	366.10	5.98	223.76	22.76
CA3-3	82.40	5.99	131.65	22.76
CA3-4	76.43	5.99	169.68	22.75
CA3-5	82.71	6.00	111.95	22.75
CA3-6	104.08	6.00	188.84	22.75
CA3-7	216.45	6.01	307.98	22.75
CA3-8	337.88	6.01	388.56	22.75
CA3-9	584.47	12.83		
CA3-9*	501.54	15.93		
CA3-10	244.00	6.00	367.04	22.75
CA3-11	440.45	12.83		
CA3-11*	432.30	15.93		
CA3-12	339.97	6.00	414.67	22.75
CA3-13	249.05	6.00	384.50	22.75
CA3-14	247.56	6.00	253.03	22.75
CA3-15	554.87	5.99	352.84	22.75
CA3-16	259.52	5.99	375.72	22.75
CA3-17	73.26	5.92	80.17	22.82
CA3-18	119.75	5.92	88.83	22.81
CA3-19	103.29	5.92	81.23	22.81
CA3-20	65.98	5.92	69.49	22.81
CA3-21	103.92	5.91	124.37	22.80
CA3-22	90.32	5.91	50.58	22.80
CA3-23	40.30	5.89	57.45	22.81
CA3-24	169.66	5.92	119.09	22.83
CA3-25	122.98	5.92	133.65	22.83
CA3-26	118.73	5.91	106.15	22.83
CA3-27	98.55	5.90	58.84	22.84
CA3-28	134.37	5.90	138.13	22.84
CA3-29	88.72	5.89	49.31	22.85
CA3-30	114.70	5.88	47.55	22.85
CA3-31	160.16	5.89	161.81	22.82

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

CHATHAM GAS FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
CH-1	LC 0667	306	13	21	504	316	16	46	376	334	15	33	256
CH-2	LB 5582	306	13	26	513	316	16	48	447	334	15	35	313
CH-3	LC 5342	306	13	33	580	316	16	50	455	334	15	38	321
CH-4	LB 4929	306	13	42	571	316	16	53	334				
CH-4*	LD 2989	316	16	53	754	334	15	43	589				
CH-5	LB 4066	306	13	48	553	316	16	56	515	334	15	45	422
CH-6	LC 5321	306	13	57	557	316	16	59	401	334	15	48	211
CH-7	LC 5420	306	14	4	574	316	17	2	475	334	15	51	228
CH-8	LB 8714	306	14	11	513	316	17	6	226				
CH-8*	LD 2783	316	17	6	748	334	13	55	567				
CH-9	LC 5442	306	14	19	504	316	17	7	368	334	15	57	195
CH-10	LB 9884	306	14	27	725	316	17	11	633	334	15	59	459
CH-11	LC 6925	306	14	38	511	316	17	13	11				
CH-11*	LD 2263	316	17	14	718	334	16	3	410				
CH-12	LC 3622	306	14	46	665	316	17	17	584	334	16	7	480
CH-13	LC 2882	306	14	51	542	316	17	20	182				
CH-13*	LD 1928	316	17	21	764	334	16	9	607				
CH-14	LC 5604	306	13	30	541	316	16	16	514	334	14	50	446
CH-15	LC 1451	306	13	35	542	316	16	20	452	334	14	53	333
CH-16	LC 5294	306	13	40	508	316	16	22	423	334	14	57	256
CH-17	LC 5712	306	13	45	594	316	16	25	561	334	15	0	501
CH-18	LC 4141	306	13	55	503	316	16	27	440	334	15	3	318
CH-19	LC 4168	306	14	0	505	316	16	30	407	334	15	7	290
CH-20	LC 3687	306	14	5	533	316	16	32	442	334	15	8	380
CH-21	LC 5661	306	14	15	578	316	16	34	439	334	15	12	215
CH-22	LB 4192	306	14	20	537	316	16	37	496	334	15	15	353
CH-23	LB 7537	306	14	25	528	316	16	39	507	334	15	17	459
CH-24	LC 3641	306	14	30	562	316	16	40	446	334	15	22	225
CH-25	LB 5304	306	14	35	510	316	16	42	460	334	15	24	385

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CHATHAM GAS FIELD

RADON CONCENTRATIONS - Averages
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CH-1	381.77	10.14	272.80	28.09
CH-2	192.74	10.14	216.69	28.09
CH-3	361.98	10.14	277.19	28.09
CH-4	706.06	10.13		
CH-4*	254.29	17.95		
CH-5	107.83	10.13	137.09	28.08
CH-6	459.51	10.13	381.09	28.08
CH-7	285.83	10.12	378.55	28.07
CH-8	884.98	10.12		
CH-8*	281.92	17.87		
CH-9	407.45	10.12	344.97	28.07
CH-10	250.96	10.11	270.04	28.06
CH-11	1615.90	10.11		
CH-11*	495.82	17.95		
CH-12	225.30	10.10	188.53	28.06
CH-13	1116.01	10.10		
CH-13*	240.66	17.95		
CH-14	76.26	10.12	98.65	28.06
CH-15	262.61	10.11	224.64	28.05
CH-16	250.99	10.11	277.39	28.05
CH-17	91.98	10.11	94.54	28.05
CH-18	185.13	10.11	200.77	28.05
CH-19	291.04	10.10	234.92	28.05
CH-20	266.86	10.10	162.68	28.04
CH-21	405.78	10.10	398.47	28.04
CH-22	117.73	10.10	197.03	28.04
CH-23	59.17	10.09	71.07	28.04
CH-24	339.05	10.09	370.25	28.04
CH-25	145.94	10.09	133.00	28.03

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CHATHAM GAS FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CH-1	381.77	10.14	211.48	17.95
CH-2	192.74	10.14	230.33	17.95
CH-3	361.98	10.14	229.58	17.95
CH-4	706.06	10.13		
CH-4*	254.29	17.95		
CH-5	107.83	10.13	153.64	17.95
CH-6	459.51	10.13	337.55	17.95
CH-7	285.83	10.12	431.40	17.95
CH-8	884.98	10.12		
CH-8*	281.92	17.87		
CH-9	407.45	10.12	310.28	17.95
CH-10	250.96	10.11	281.01	17.95
CH-11	1615.90	10.11		
CH-11*	495.82	17.95		
CH-12	225.30	10.10	167.91	17.95
CH-13	1116.01	10.10		
CH-13*	240.66	17.95		
CH-14	76.26	10.12	111.28	17.94
CH-15	262.61	10.11	203.38	17.94
CH-16	250.99	10.11	292.51	17.94
CH-17	91.98	10.11	96.00	17.94
CH-18	185.13	10.11	209.67	17.94
CH-19	291.04	10.10	203.48	17.94
CH-20	266.86	10.10	104.07	17.94
CH-21	405.78	10.10	395.11	17.94
CH-22	117.73	10.10	241.71	17.94
CH-23	59.17	10.09	77.77	17.94
CH-24	339.05	10.09	388.37	17.95
CH-25	145.94	10.09	125.76	17.95

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

CLEARVILLE OIL FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
CL-1	LD 2692	308	9	42	744	316	10	15	726	334	9	38	644
CL-2	LD 2644	308	9	53	729	316	10	19	714	334	9	44	686
CL-3	LD 2561	308	10	1	758	316	10	23	745	334	9	46	724
CL-4	LD 2442	308	10	10	759	316	10	27	741	334	9	49	713
CL-5	LD 2663	308	10	18	760	316	10	8	739	334	9	32	714
CL-6	LD 2662	308	10	27	753	316	10	30	736	334	9	52	622
CL-7	LD 3047	308	10	36	731	316	10	33	713	334	9	56	685
CL-8	LD 2866	308	10	44	750	316	10	55	726	334	9	58	706
CL-9	LD 2467	308	10	49	763	316	10	38	744	334	10	2	721
CL-10	LC 5307	308	10	57	583	316	10	40	562	334	10	5	515
CL-11	LC 2867	308	11	5	553	316	11	3	513	334	10	7	450
CL-12	LC 5649	308	11	16	575	316	11	5	558	334	10	11	528
CL-13	LB 3800	308	11	21	510	316	11	9	488	334	10	15	470
CL-14	LC 0682	308	11	34	514	316	11	18	482	334	10	23	490
CL-15	LC 5711	308	12	2	568	316	11	15	543	334	10	19	517
CL-16	LD 2688	308	11	50	759	316	9	18	742	334	8	51	726
CL-17	LD 2820	308	12	0	758	316	9	16	749	334	8	49	734
CL-18	LD 2698	308	12	5	756	316	9	14	737	334	8	47	709
CL-19	LD 2551	308	12	10	753	316	9	11	741	334	8	45	698
CL-20	LD 3096	308	12	15	757	316	9	9	750	334	8	41	742
CL-21	LD 2428	308	12	20	726	316	9	7	712	334	8	39	697
CL-22	LD 3122	308	12	25	763	316	9	5	739	334	8	36	719
CL-23	LD 2139	308	12	30	755	316	9	2	750	334	8	34	733
CL-24	LD 2165	308	12	40	741	316	8	59	700	334	8	31	626
CL-25	LD 2752	308	12	45	759	316	8	57	730	334	8	29	667
CL-26	LD 2708	308	12	50	759	316	8	55	725	334	8	27	686
CL-27	LD 2949	308	12	55	763	316	8	53	695	334	8	26	507
CL-28	LD 2778	308	13	0	753	316	8	51	721	334	8	23	676
CL-29	LD 2749	308	13	5	755	316	8	48	713	334	8	21	643
CL-30	LD 2735	308	13	10	742	316	8	46	701	334	8	18	644
CL-31	LD 2482	308	10	0	754	316	9	23	724	334	8	55	627
CL-32	LD 2806	308	9	55	751	316	9	25	730	334	8	57	674
CL-33	LD 2819	308	9	50	755	316	9	27	727	334	8	59	582
CL-34	LD 2434	308	9	45	762	316	9	30	736	334	9	1	716
CL-35	LD 2690	308	9	40	750	316	9	33	726	334	9	3	693
CL-36	LD 2585	308	9	35	757	316	9	34	742	334	9	4	702
CL-37	LD 2429	308	10	10	759	316	9	36	746	334	9	6	699
CL-38	LD 2734	308	10	20	758	316	9	39	744	334	9	8	658
CL-39	LD 2633	308	10	25	756	316	9	41	731	334	9	11	675
CL-40	LD 2851	308	10	30	757	316	9	44	738	334	9	13	673
CL-41	LD 3066	308	10	35	758	316	9	46	723	334	9	15	637
CL-42	LD 2592	308	10	40	745	316	9	48	729	334	9	17	226
CL-43	LD 2805	308	10	45	760	316	9	52	747	334	9	20	731
CL-44	LD 2443	308	10	50	757	316	9	54	730	334	9	22	698
CL-45	LD 2555	308	10	55	746	316	9	57	739	334	9	24	683

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CLEARVILLE OIL FIELD Radon Concentrations - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CL-1	58.95	8.02	104.23	26.00
CL-2	49.01	8.02	43.30	25.99
CL-3	41.72	8.02	33.34	25.99
CL-4	58.71	8.01	46.01	25.99
CL-5	69.06	7.99	46.02	25.97
CL-6	55.50	8.00	137.69	25.98
CL-7	59.42	8.00	46.51	25.97
CL-8	79.43	8.01	44.07	25.97
CL-9	62.18	7.99	41.75	25.97
CL-10	73.78	7.99	74.16	25.96
CL-11	144.57	8.00	115.63	25.96
CL-12	59.40	7.99	50.52	25.95
CL-13	79.60	7.99	43.71	25.95
CL-14	116.91	7.99	25.19	25.95
CL-15	89.09	7.97	55.27	25.93
CL-16	56.17	7.89	32.43	25.88
CL-17	28.66	7.89	22.93	25.87
CL-18	63.25	7.88	47.35	25.86
CL-19	39.12	7.88	55.96	25.86
CL-20	21.83	7.87	13.46	25.85
CL-21	46.56	7.87	28.59	25.85
CL-22	80.58	7.86	44.09	25.84
CL-23	14.97	7.86	20.88	25.84
CL-24	141.06	7.85	121.47	25.83
CL-25	98.32	7.84	95.71	25.82
CL-26	115.84	7.84	75.23	25.82
CL-27	235.20	7.83	278.22	25.81
CL-28	109.23	7.83	79.73	25.81
CL-29	144.33	7.82	117.70	25.80
CL-30	141.56	7.82	102.94	25.80
CL-31	100.25	7.97	133.38	25.95
CL-32	69.41	7.98	79.31	25.96
CL-33	93.23	7.98	183.91	25.96
CL-34	86.10	7.99	45.99	25.97
CL-35	79.56	8.00	57.89	25.97
CL-36	48.63	8.00	55.61	25.98
CL-37	41.92	7.98	60.94	25.96
CL-38	45.38	7.97	103.90	25.95
CL-39	83.08	7.97	83.50	25.95
CL-40	62.51	7.97	86.70	25.95
CL-41	117.41	7.97	126.70	25.94
CL-42	52.51	7.96	595.93	25.94
CL-43	41.98	7.96	28.11	25.94
CL-44	90.01	7.96	59.96	25.94
CL-45	21.65	7.96	64.49	25.94

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

CLEARVILLE OIL FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CL-1	58.95	8.02	124.45	17.97
CL-2	49.01	8.02	40.75	17.98
CL-3	41.72	8.02	29.60	17.97
CL-4	58.71	8.01	40.35	17.97
CL-5	69.06	7.99	35.78	17.98
CL-6	55.50	8.00	174.29	17.97
CL-7	59.42	8.00	40.77	17.97
CL-8	79.43	8.01	28.30	17.96
CL-9	62.18	7.99	32.66	17.98
CL-10	73.78	7.99	74.33	17.98
CL-11	144.57	8.00	102.75	17.96
CL-12	59.40	7.99	46.57	17.96
CL-13	79.60	7.99	27.74	17.96
CL-14	116.91	7.99	-15.61	17.96
CL-15	89.09	7.97	40.27	17.96
CL-16	56.17	7.89	22.00	17.98
CL-17	28.66	7.89	20.42	17.98
CL-18	63.25	7.88	40.39	17.98
CL-19	39.12	7.88	63.33	17.98
CL-20	21.83	7.87	9.80	17.98
CL-21	46.56	7.87	20.72	17.98
CL-22	80.58	7.86	28.13	17.98
CL-23	14.97	7.86	23.45	17.98
CL-24	141.06	7.85	112.94	17.98
CL-25	98.32	7.84	94.58	17.98
CL-26	115.84	7.84	57.53	17.98
CL-27	235.20	7.83	297.11	17.98
CL-28	109.23	7.83	66.90	17.98
CL-29	144.33	7.82	106.13	17.98
CL-30	141.56	7.82	86.17	17.98
CL-31	100.25	7.97	148.09	17.98
CL-32	69.41	7.98	83.71	17.98
CL-33	93.23	7.98	224.20	17.98
CL-34	86.10	7.99	28.16	17.98
CL-35	79.56	8.00	48.26	17.98
CL-36	48.63	8.00	58.71	17.98
CL-37	41.92	7.98	69.37	17.98
CL-38	45.38	7.97	129.85	17.98
CL-39	83.08	7.97	83.69	17.98
CL-40	62.51	7.97	97.42	17.98
CL-41	117.41	7.97	130.84	17.98
CL-42	52.51	7.96	836.88	17.98
CL-43	41.98	7.96	21.96	17.98
CL-44	90.01	7.96	46.65	17.98
CL-45	21.65	7.96	83.45	17.98

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

COVENY FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
CO-1	LB 3981	305	8	55	522	315	9	5	438	333	12	50	388
CO-2	LB 2825	305	9	5	547	315	9	2	502	333	12	48	420
CO-3	LC 4314	305	9	10	507	315	9	0	488	333	12	54	444
CO-4	LB 2999	305	9	15	531	315	8	57	497	333	12	57	427
CO-5	LC 4144	305	9	20	575	315	8	55	547	333	13	1	496
CO-6	LC 5729	305	9	26	585	315	8	52	558	333	13	3	509
CO-7	LC 5628	305	9	32	515	315	8	50	469	333	12	42	390
CO-8	LC 4210	305	9	38	538	315	8	45	458	333	12	40	308
CO-9	LC 3632	305	9	45	505	315	8	40	466	333	12	37	406
CO-10	LC 5640	305	9	53	522	315	8	35	425	333	12	35	319
CO-11	LC 6955	305	10	5	573	315	8	22	556	333	12	28	496
CO-12	LB 5777	305	10	11	546	315	8	16	513	333	12	26	450
CO-13	LC 4139	305	10	15	533	315	8	13	517	333	12	21	492
CO-14	LC 3644	305	10	23	560	317	9	35	285	333	12	20	0
CO-15	LC 3624	305	10	24	533	315	8	5	432	333	12	18	267
CO-16	LC 5575	305	8	55	545	311	8	53	530	333	12	5	386
CO-17	LC 4123	305	9	5	569	311	8	50	558	333	12	2	481
CO-18	LC 6927	305	9	10	506	311	8	47	488	333	11	59	413
CO-19	LC 5626	305	9	15	533	311	8	45	519	333	11	56	466
CO-20	LC 5332	305	9	20	509	311	8	40	446	333	11	53	377
CO-21	LC 0670	305	9	30	577	311	8	36	565	333	11	51	464
CO-22	LC 5260	305	9	35	528	311	8	35	509	333	11	48	438
CO-23	LB 4011	305	10	40	535	311	8	31	523	333	11	46	432
CO-24	LB 5517	305	10	35	520	311	8	28	502	333	11	43	418
CO-25	LC 8363	305	10	30	571	311	8	25	556	333	11	39	484
CO-26	LB 5985	305	10	20	549	311	8	23	530	333	11	37	441
CO-27	LB 5029	305	10	15	557	311	8	20	549	333	11	33	472
CO-28	LC 5651	305	10	5	510	311	8	17	497	333	11	31	431
CO-29	LB 8617	305	10	0	665	311	8	14	637	333	11	29	586
CO-30	LC 5697	305	9	55	501	311	8	12	481	333	11	23	322

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

COVENY FIELD

RADON CONCENTRATION - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CO-1	249.24	10.01	141.66	28.16
CO-2	130.32	10.00	132.69	28.15
CO-3	54.30	9.99	64.87	28.16
CO-4	98.40	9.99	108.44	28.15
CO-5	79.22	9.98	80.04	28.15
CO-6	76.05	9.98	76.58	28.15
CO-7	135.32	9.97	132.27	28.13
CO-8	236.67	9.96	248.22	28.13
CO-9	114.85	9.95	104.20	28.12
CO-10	290.68	9.95	219.14	28.11
CO-11	47.40	9.93	78.14	28.10
CO-12	95.53	9.92	99.40	28.09
CO-13	45.24	9.92	40.91	28.09
CO-14	701.85	11.97	644.91	28.08
CO-15	303.01	9.90	290.56	28.08
CO-16	71.02	6.00	168.01	28.13
CO-17	51.03	5.99	89.88	28.12
CO-18	87.26	5.98	97.60	28.12
CO-19	66.65	5.98	68.59	28.11
CO-20	314.11	5.97	140.46	28.11
CO-21	55.98	5.96	116.37	28.10
CO-22	91.87	5.96	93.60	28.09
CO-23	57.42	5.91	107.61	28.05
CO-24	87.87	5.91	107.14	28.05
CO-25	71.36	5.91	88.99	28.05
CO-26	91.75	5.92	112.41	28.05
CO-27	37.10	5.92	87.31	28.05
CO-28	62.86	5.93	82.38	28.06
CO-29	130.57	5.93	77.61	28.06
CO-30	98.37	5.93	194.01	28.06

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

COVENY FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
CO-1	249.24	10.01	82.40	18.16
CO-2	130.32	10.00	134.03	18.16
CO-3	54.30	9.99	70.69	18.16
CO-4	98.40	9.99	113.97	18.17
CO-5	79.22	9.98	80.49	18.17
CO-6	76.05	9.98	76.87	18.17
CO-7	135.32	9.97	130.63	18.16
CO-8	236.67	9.96	254.73	18.16
CO-9	114.85	9.95	98.38	18.16
CO-10	290.68	9.95	180.10	18.17
CO-11	47.40	9.93	94.94	18.17
CO-12	95.53	9.92	101.52	18.17
CO-13	45.24	9.92	38.55	18.17
CO-14	701.85	11.97	606.44	16.11
CO-15	303.01	9.90	284.06	18.18
CO-16	71.02	6.00	194.32	22.13
CO-17	51.03	5.99	100.40	22.13
CO-18	87.26	5.98	100.41	22.13
CO-19	66.65	5.98	69.12	22.13
CO-20	314.11	5.97	93.64	22.13
CO-21	55.98	5.96	132.65	22.14
CO-22	91.87	5.96	94.07	22.13
CO-23	57.42	5.91	121.01	22.14
CO-24	87.87	5.91	112.30	22.14
CO-25	71.36	5.91	93.70	22.13
CO-26	91.75	5.92	117.94	22.13
CO-27	37.10	5.92	100.74	22.13
CO-28	62.86	5.93	87.61	22.13
CO-29	130.57	5.93	63.43	22.14
CO-30	98.37	5.93	219.66	22.13

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

DAWN GAS FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
DG-1	LC 5333	309	14	17	577	315	16	40	527	335	11	16	416
DG-2	LD 2693	309	14	27	760	315	16	36	713	335	11	13	600
DG-3	LB 2702	309	14	36	537	315	16	45	515	335	11	9	426
DG-4	LD 2464	309	14	39	763	315	16	30	692	335	11	5	472
DG-5	LD 2517	309	14	47	758	315	16	25	611	335	10	58	170
DG-6	LD 2775	309	14	55	743	315	16	22	619	335	10	52	426
DG-7	LD 2545	309	15	6	753	315	16	23	697	335	10	49	526
DG-8	LD 2566	309	15	12	759	315	16	18	672	335	10	45	501
DG-9	LD 2788	309	15	17	756	315	16	13	698	335	10	42	402
DG-10	LD 2335	309	15	26	737	315	16	7	691	335	10	36	565
DG-11	LD 2563	309	15	31	752	315	16	2	644	335	10	32	355
DG-12	LD 2489	309	15	57	758	315	15	15	711	335	9	55	434
DG-13	LD 3103	309	16	7	759	315	15	17	642	335	9	58	180
DG-14	LD 2685	309	16	14	759	315	15	25	724	335	10	3	660
DG-15	LD 2472	309	16	22	755	315	15	30	682	335	10	10	559
DG-16	LD 2640	309	16	28	757	315	15	33	661	335	10	14	596
DG-17	LD 2714	309	16	32	759	315	15	35	638	335	10	16	481
DG-18	LD 2601	309	16	15	733	315	15	5	724	335	9	46	544
DG-19	LD 2907	309	16	20	718	315	15	3	633	335	9	41	475
DG-20	LB 4758	309	16	30	594	315	15	0	567	335	9	38	397

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DAWN GAS FIELD

RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DG-1	236.75	6.10	182.99	25.87
DG-2	208.27	6.09	169.87	25.87
DG-3	104.09	6.09	126.27	25.86
DG-4	317.46	6.08	318.12	25.85
DG-5	670.85	6.07	683.77	25.84
DG-6	566.95	6.06	351.27	25.83
DG-7	251.11	6.05	245.95	25.82
DG-8	393.20	6.05	280.90	25.81
DG-9	260.61	6.04	393.69	25.81
DG-10	207.53	6.03	185.19	25.80
DG-11	493.70	6.02	446.30	25.79
DG-12	212.61	5.97	358.71	25.75
DG-13	539.62	5.97	674.38	25.74
DG-14	157.48	5.97	103.63	25.74
DG-15	333.76	5.96	211.37	25.74
DG-16	441.28	5.96	172.00	25.74
DG-17	559.00	5.96	304.87	25.74
DG-18	39.08	5.95	205.21	25.73
DG-19	396.17	5.95	268.68	25.72
DG-20	128.91	5.94	225.92	25.71

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DAWN GAS FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DG-1	236.75	6.10	166.46	19.78
DG-2	208.27	6.09	158.08	19.78
DG-3	104.09	6.09	133.12	19.77
DG-4	317.46	6.08	318.54	19.77
DG-5	670.85	6.07	689.78	19.77
DG-6	566.95	6.06	285.53	19.77
DG-7	251.11	6.05	244.47	19.77
DG-8	393.20	6.05	246.74	19.77
DG-9	260.61	6.04	434.63	19.77
DG-10	207.53	6.03	178.43	19.77
DG-11	493.70	6.02	432.48	19.77
DG-12	212.61	5.97	403.02	19.78
DG-13	539.62	5.97	716.68	19.78
DG-14	157.48	5.97	87.39	19.78
DG-15	333.76	5.96	174.54	19.78
DG-16	441.28	5.96	90.88	19.78
DG-17	559.00	5.96	228.53	19.78
DG-18	39.08	5.95	255.21	19.78
DG-19	396.17	5.95	230.50	19.78
DG-20	128.91	5.94	255.09	19.78

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

DOVER FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
DO-1	LC 5654	306	10	46	612	316	15	38	576	334	14	18	551
DO-2	LC 2955	306	10	40	629	316	15	34	587	334	14	15	495
DO-3	LC 6942	306	10	33	689	316	15	32	517	334	14	12	400
DO-4	LC 6926	306	10	28	744	316	15	27	688	334	14	9	632
DO-5	LC 6956	306	10	23	675	316	15	25	590	334	14	7	517
DO-6	LC 6909	306	10	16	752	316	15	21	707	334	14	4	654
DO-7	LC 3684	306	10	15	711	316	15	18	682	334	14	2	651
DO-8	LC 6913	306	10	20	663	316	15	15	567	334	13	59	469
DO-9	LB 8521	306	10	27	678	316	15	13	617	334	13	55	513
DO-10	LC 5520	306	10	35	500	316	15	10	454	334	13	53	432
DO-11	LA 3749	306	10	40	682	316	15	7	631	334	13	50	566
DO-12	LC 6943	306	11	12	712	316	15	45	611	334	12	21	501
DO-13	LC 6911	306	11	20	701	316	13	18	647	334	12	19	600
DO-14	LC 6906	306	11	28	684	316	13	16	575	334	12	13	444
DO-15	LB 2922	306	11	33	670	316	13	13	547	334	12	16	362
DO-16	LC 0677	306	11	39	641	316	13	6	610	334	12	9	521
DO-17	LC 5718	306	11	47	607	316	13	9	502	334	12	7	445
DO-18	LC 8320	306	11	50	606	316	13	3	511	334	12	5	390
DO-19	LC 8328	306	11	10	620	316	13	23	542	334	12	24	437
DO-20	LC 4283	306	11	15	623	316	13	24	554	334	12	27	497
DO-21	LC 4227	306	11	20	652	316	13	28	622	334	12	29	518
DO-22	LC 6953	306	11	25	710	316	13	30	691	334	12	31	674
DO-23	LB 8243	306	11	30	709	316	13	33	635	334	12	34	518
DO-24	LB 4573	306	11	35	602	316	13	36	529	334	12	36	487
DO-25	LC 8276	306	11	45	607	316	13	39	558	334	12	38	529
DO-26	LB 5224	306	11	50	658	316	13	42	608	334	12	41	545
DO-27	LD 2509	308	15	50	729	316	12	48	682	334	11	57	618
DO-28	LC 5610	308	15	55	532	316	12	52	511	334	12	1	481
DO-29	LB 3668	308	16	0	524	316	13	45	498	334	12	44	381
DO-30	LD 2687	308	16	5	762	316	13	48	734	334	12	46	657
DO-31	LC 6970	308	15	10	576	316	12	25	540	334	11	30	427
DO-32	LD 2628	308	15	20	758	316	12	28	743	334	11	33	666
DO-33	LD 2571	308	15	25	762	316	12	31	719	334	11	36	666
DO-34	LD 2577	308	15	14	756	316	12	33	677	334	11	37	472
DO-35	LD 2454	308	15	18	757	316	12	36	672	334	11	39	586
DO-36	LD 2680	308	15	23	756	316	12	38	704	334	11	41	645
DO-37	LD 2549	308	15	30	758	316	12	41	677	334	11	45	606
DO-38	LB 2773	308	15	40	500	316	12	45	401	334	11	50	158

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DOVER FIELD

RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DO-1	99.01	10.20	60.21	28.15
DO-2	115.27	10.20	136.00	28.15
DO-3	479.89	10.21	297.90	28.15
DO-4	148.46	10.21	108.11	28.15
DO-5	233.40	10.21	158.70	28.16
DO-6	118.22	10.21	93.78	28.16
DO-7	76.29	10.21	56.99	28.16
DO-8	265.73	10.20	197.61	28.15
DO-9	166.12	10.20	165.93	28.14
DO-10	133.12	10.19	70.51	28.14
DO-11	138.24	10.19	114.80	28.13
DO-12	275.40	10.19	212.70	28.05
DO-13	147.09	10.08	99.01	28.04
DO-14	304.32	10.08	246.26	28.03
DO-15	346.55	10.07	322.49	28.03
DO-16	85.16	10.06	121.25	28.02
DO-17	301.87	10.06	167.99	28.01
DO-18	272.67	10.05	227.20	28.01
DO-19	220.66	10.09	189.62	28.05
DO-20	194.45	10.09	128.30	28.05
DO-21	81.75	10.09	135.33	28.05
DO-22	49.75	10.09	33.28	28.05
DO-23	202.50	10.09	191.85	28.04
DO-24	207.75	10.08	117.63	28.04
DO-25	137.87	10.08	78.35	28.04
DO-26	138.14	10.08	113.11	28.04
DO-27	162.34	7.87	117.54	25.84
DO-28	76.38	7.87	56.26	25.84
DO-29	95.09	7.91	165.15	25.86
DO-30	93.96	7.90	109.53	25.86
DO-31	130.54	7.89	169.03	25.85
DO-32	49.38	7.88	95.67	25.84
DO-33	146.39	7.88	99.86	25.84
DO-34	272.86	7.89	310.84	25.85
DO-35	293.99	7.89	182.39	25.85
DO-36	178.03	7.89	116.37	25.85
DO-37	279.92	7.88	161.28	25.84
DO-38	378.56	7.88	418.68	25.84

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DOVER FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DO-1	99.01	10.20	38.16	17.94
DO-2	115.27	10.20	147.82	17.95
DO-3	479.89	10.21	194.71	17.94
DO-4	148.46	10.21	85.18	17.95
DO-5	233.40	10.21	116.26	17.95
DO-6	118.22	10.21	79.88	17.95
DO-7	76.29	10.21	46.01	17.95
DO-8	265.73	10.20	158.98	17.95
DO-9	166.12	10.20	165.88	17.95
DO-10	133.12	10.19	34.97	17.95
DO-11	138.24	10.19	101.52	17.95
DO-12	275.40	10.19	177.05	17.86
DO-13	147.09	10.08	72.04	17.96
DO-14	304.32	10.08	213.87	17.96
DO-15	346.55	10.07	309.41	17.96
DO-16	85.16	10.06	141.48	17.96
DO-17	301.87	10.06	93.06	17.96
DO-18	272.67	10.05	201.90	17.96
DO-19	220.66	10.09	172.27	17.96
DO-20	194.45	10.09	91.17	17.96
DO-21	81.75	10.09	165.45	17.96
DO-22	49.75	10.09	24.03	17.96
DO-23	202.50	10.09	185.96	17.96
DO-24	207.75	10.08	67.04	17.96
DO-25	137.87	10.08	44.95	17.96
DO-26	138.14	10.08	99.08	17.96
DO-27	162.34	7.87	97.93	17.96
DO-28	76.38	7.87	47.44	17.96
DO-29	95.09	7.91	196.02	17.96
DO-30	93.96	7.90	116.39	17.96
DO-31	130.54	7.89	185.97	17.96
DO-32	49.38	7.88	115.98	17.96
DO-33	146.39	7.88	79.46	17.96
DO-34	272.86	7.89	327.76	17.96
DO-35	293.99	7.89	133.43	17.96
DO-36	178.03	7.89	89.31	17.96
DO-37	279.92	7.88	109.25	17.96
DO-38	378.56	7.88	436.86	17.96

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

DOVER NEW FIELD POOL 7 - 5 VE RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V (i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
DN-1	LD 2609	308	16	38	762	316	14	55	717	334	13	40	628
DN-2	LD 2665	308	16	35	710	316	14	50	615	334	13	37	440
DN-2#	LD 2206	316	14	50	741	334	13	37	575				
DN-3	LD 2445	308	16	59	741	316	14	43	639	334	13	34	421
DN-3#	LD 2814	316	14	43	755	334	13	35	535				
DN-4	LD 2562	308	17	2	750	316	14	41	730	334	13	31	660
DN-5	LD 2520	308	17	5	762	316	14	38	728	334	13	29	607
DN-6	LD 2528	308	17	9	759	316	14	35	737	334	13	26	602
DN-7	LD 2553	308	17	13	761	316	14	30	745	334	13	24	713
DN-8	LD 2461	308	17	16	756	316	14	27	743	334	13	20	726
DN-9	LD 2603	308	17	21	745	316	14	25	737	334	13	17	710
DN-10	LD 2547	308	17	24	760	316	14	22	729	334	13	14	590
DN-11	LD 2630	308	17	25	750	316	14	18	719	334	13	12	659
DN-12	LB 3840	308	17	26	584	316	14	16	531	334	13	10	455
DN-13	LD 2625	308	17	29	750	316	14	14	706	334	13	7	574
DN-14	LC 5713	308	17	33	598	316	14	11	366				
DN-14*	LD 3117	316	14	11	760	334	13	5	525				
DN-15	LC 5511	308	17	34	583	316	14	7	512	334	12	59	364
DN-16	LB 3042	308	17	36	573	316	14	3	450	334	12	57	227
DN-17	LC 5318	308	17	38	546	316	13	59	443	334	12	53	269
DN-18	LC 5350	308	17	41	548	316	13	57	465	334	12	51	208

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DOVER NEW FIELD
POOL 7 - 5 - VE

RADON CONCENTRATIONS - Averages
(from date of deployment)
(gamma corrected for 19.13uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DN-1	152.39	7.93	141.06	25.88
DN-2	333.33	7.93	299.38	25.88
DN-2#	257.13	17.95		
DN-3	355.52	7.91	354.72	25.86
DN-3#	343.07	17.95		
DN-4	66.67	7.90	93.74	25.85
DN-5	114.81	7.90	164.32	25.85
DN-6	73.44	7.89	166.74	25.85
DN-7	52.74	7.89	48.37	25.84
DN-8	42.50	7.88	29.33	25.84
DN-9	25.37	7.88	34.79	25.83
DN-10	104.82	7.87	181.23	25.83
DN-11	105.24	7.87	94.93	25.82
DN-12	193.73	7.87	145.17	25.82
DN-13	150.80	7.86	188.65	25.82
DN-14	881.54	7.86		
DN-14*	366.92	17.95		
DN-15	261.68	7.86	252.61	25.81
DN-16	461.50	7.85	412.18	25.81
DN-17	388.81	7.85	328.60	25.80
DN-18	311.57	7.84	408.69	25.80

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

DOVER NEW FIELD (incremental)
POOL 7 - 5 - VE

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
DN-1	152.39	7.93	136.08	17.95
DN-2	333.33	7.93	284.63	17.95
DN-2#	257.13	17.95		
DN-3	355.52	7.91	354.75	17.95
DN-3#	343.07	17.95		
DN-4	66.67	7.90	105.65	17.95
DN-5	114.81	7.90	186.13	17.95
DN-6	73.44	7.89	207.78	17.95
DN-7	52.74	7.89	46.46	17.95
DN-8	42.50	7.88	23.56	17.95
DN-9	25.37	7.88	38.92	17.95
DN-10	104.82	7.87	214.77	17.95
DN-11	105.24	7.87	90.42	17.95
DN-12	193.73	7.87	123.92	17.95
DN-13	150.80	7.86	205.29	17.95
DN-14	881.54	7.86		
DN-14*	366.92	17.95		
DN-15	261.68	7.86	248.78	17.95
DN-16	461.50	7.85	391.24	17.95
DN-17	388.81	7.85	302.61	17.95
DN-18	311.57	7.84	451.61	17.95

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

FLORENCE-OAKDALE FIELD RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V (i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
FL-1	LD 2507	309	14	15	759	315	13	52	752	335	8	40	721
FL-2	LC 5259	309	14	20	545	315	13	55	491	335	8	44	381
FL-3	LD 2726	309	14	25	754	315	13	57	627	335	8	46	476
FL-4	LD 2297	309	14	30	755	315	14	1	719	335	8	49	650
FL-5	LD 2976	309	14	35	758	315	14	3	722	335	8	52	629
FL-6	LD 2943	309	14	40	759	315	14	15	739	335	8	54	666
FL-7	LD 1957	309	14	45	756	315	14	10	746	335	8	56	710
FL-8	LD 2918	309	14	50	760	315	14	17	726	335	8	58	571
FL-9	LD 2347	309	14	55	753	315	14	20	733	335	9	2	665
FL-10	LD 2792	309	15	0	745	315	14	25	641	335	9	4	235
FL-11	LD 2756	309	15	5	763	315	14	30	736	335	9	7	594
FL-12	LD 2804	309	15	10	756	315	14	33	753	335	9	8	706
FL-13	LD 2746	309	15	15	756	315	14	35	615	335	9	12	591
FL-14	LC 5690	309	15	25	501	315	14	36	495	335	9	14	469
FL-15	LB 8795	309	15	30	557	315	14	40	532	335	9	16	222
FL-16	LC 5450	309	15	35	519	315	14	43	487	335	9	19	253
FL-17	LB 3071	309	15	40	505	315	14	45	482	335	9	21	426
FL-18	LD 2579	309	15	45	757	315	14	47	729	335	9	24	672

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

FLORENCE-OAKDALE FIELD

RADON CONCENTRATION - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
FL-1	29.41	5.98	37.89	25.77
FL-2	264.29	5.98	189.68	25.77
FL-3	586.52	5.98	305.12	25.76
FL-4	161.92	5.98	110.23	25.76
FL-5	161.81	5.98	136.40	25.76
FL-6	88.51	5.98	97.03	25.76
FL-7	43.13	5.98	46.49	25.76
FL-8	152.55	5.98	203.00	25.76
FL-9	88.81	5.98	91.83	25.75
FL-10	479.85	5.98	588.87	25.75
FL-11	120.42	5.98	180.45	25.75
FL-12	11.32	5.97	50.78	25.75
FL-13	653.50	5.97	176.47	25.75
FL-14	27.63	5.97	34.88	25.74
FL-15	120.26	5.97	401.71	25.74
FL-16	157.08	5.96	318.96	25.74
FL-17	112.71	5.96	90.20	25.74
FL-18	125.59	5.96	88.51	25.74

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

FLORENCE-OAKDALE FIELD (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
FL-1	29.41	5.98	40.46	19.78
FL-2	264.29	5.98	167.17	19.78
FL-3	586.52	5.98	220.31	19.78
FL-4	161.92	5.98	94.62	19.78
FL-5	161.81	5.98	128.74	19.78
FL-6	88.51	5.98	99.62	19.78
FL-7	43.13	5.98	47.50	19.78
FL-8	152.55	5.98	218.29	19.78
FL-9	88.81	5.98	92.74	19.78
FL-10	479.85	5.98	622.93	19.78
FL-11	120.42	5.98	198.62	19.78
FL-12	11.32	5.97	62.71	19.77
FL-13	653.50	5.97	32.43	19.78
FL-14	27.63	5.97	37.07	19.78
FL-15	120.26	5.97	486.77	19.78
FL-16	157.08	5.96	367.90	19.78
FL-17	112.71	5.96	83.42	19.78
FL-18	125.59	5.96	77.34	19.78

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

SOIL GAS RADON CONCENTRATIONS

OIL CITY RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V (i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
OC-1	LC 3674	305	12	41	638	315	10	15	606	335	14	22	519
OC-2	LC 5589	305	12	48	604	315	10	11	547	335	14	18	396
OC-3	LC 8357	305	12	54	632	317	7	50	374	317	7	50	374
OC-3*	LD 1992	317	7	50	758	335	14	15	495				
OC-4	LC 6947	305	13	2	681	315	10	5	596	335	14	12	353
OC-5	LA 3600	305	13	6	723	315	10	2	601	335	14	9	535
OC-6	LB 8220	305	13	15	654	315	9	59	548	335	14	6	247
OC-7	LC 3681	305	13	25	693	315	9	57	525	335	14	2	125
OC-8	LC 6938	305	13	31	677	315	9	52	497	335	13	59	99
OC-9	LB 8645	305	13	37	651	315	9	50	494	335	13	57	214
OC-10	LC 6908	305	13	44	618	315	9	47	595	335	13	53	537
OC-11	LC 6966	305	13	50	643	315	9	45	515	335	13	51	217
OC-12	LC 6957	305	13	54	653	315	9	42	439	335	13	45	210
OC-13	LC 6919	305	13	59	672	315	9	40	597	335	13	49	524
OC-14	AUGER												
OC-15	AUGER												
OC-16	AUGER												
OC-17	LB 6172	305	14	15	601	311	9	40	586	335	15	9	496
OC-18	LB 8543	305	14	7	571	315	10	40	560	335	15	5	545
OC-19	LB 6151	305	14	0	623	315	10	41	610	335	15	11	587
OC-20	LC 5241	305	13	50	562	317	7	35	452	335	15	7	352
OC-21	LB 8342	305	13	45	640	315	10	43	607	335	15	18	534
OC-22	LC 6910	305	13	30	702	315	10	44	666	335	15	3	652
OC-23	LC 1425	305	13	20	598	315	10	45	459	335	15	10	211
OC-24	LB 8333	305	13	15	673	315	10	47	628	335	15	15	502
OC-25	LC 5255	305	13	5	632	315	10	48	590	335	15	14	422
OC-26	LC 6899	305	13	0	714	315	10	49	677	335	15	20	578
OC-27	LC 8330	305	12	50	661	315	10	50	640	335	15	16	606
OC-28	LD 2560	309	13	5	755	315	10	17	731	335	14	24	489
OC-29	AUGER												
OC-30	AUGER												
OC-31	LD 2615	309	13	10	758	315	10	20	753	335	14	27	705

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

OIL CITY

RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
OC-1	89.57	9.90	111.98	30.07
OC-2	164.29	9.89	203.46	30.06
OC-3	647.77	11.79	647.77	11.79
OC-3*				
OC-4	240.81	9.88	320.22	30.05
OC-5	343.86	9.87	175.08	30.04
OC-6	305.45	9.86	408.40	30.04
OC-7	484.43	9.86	580.43	30.03
OC-8	523.83	9.85	595.76	30.02
OC-9	459.33	9.84	442.09	30.01
OC-10	64.54	9.84	75.68	30.01
OC-11	373.63	9.83	431.52	30.00
OC-12	634.28	9.83	448.67	29.99
OC-13	213.76	9.82	139.17	29.99
OC-14				
OC-15				
OC-16				
OC-17	71.85	5.81	99.77	30.04
OC-18	30.09	9.86	22.89	30.04
OC-19	35.24	9.86	31.96	30.05
OC-20	275.61	11.74	208.95	30.05
OC-21	92.63	9.87	99.19	30.06
OC-22	98.92	9.88	44.04	30.06
OC-23	411.07	9.89	394.77	30.08
OC-24	125.59	9.90	161.29	30.08
OC-25	118.69	9.90	203.14	30.09
OC-26	101.06	9.91	125.01	30.10
OC-27	57.27	9.92	49.41	30.10
OC-28	108.75	5.88	287.83	26.05
OC-29				
OC-30				
OC-31	20.74	5.88	53.30	26.05

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

OIL CITY (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
OC-1	89.57	9.90	122.98	20.17
OC-2	164.29	9.89	222.75	20.17
OC-3	647.77	11.79		
OC-3*	406.18	18.27		
OC-4	240.81	9.88	359.45	20.17
OC-5	343.86	9.87	92.55	20.17
OC-6	305.45	9.86	459.46	20.17
OC-7	484.43	9.86	629.51	20.17
OC-8	523.83	9.85	633.30	20.17
OC-9	459.33	9.84	434.77	20.17
OC-10	64.54	9.84	81.12	20.17
OC-11	373.63	9.83	460.64	20.17
OC-12	634.28	9.83	359.51	20.17
OC-13	213.76	9.82	102.89	20.17
OC-14				
OC-15				
OC-16				
OC-17	71.85	5.81	106.47	24.23
OC-18	30.09	9.86	19.37	20.18
OC-19	35.24	9.86	30.36	20.19
OC-20	275.61	11.74	166.37	18.31
OC-21	92.63	9.87	102.41	20.19
OC-22	98.92	9.88	17.16	20.18
OC-23	411.07	9.89	387.56	20.18
OC-24	125.59	9.90	178.84	20.19
OC-25	118.69	9.90	244.65	20.18
OC-26	101.06	9.91	136.79	20.19
OC-27	57.27	9.91	45.56	20.18
OC-28	108.75	5.88	340.14	20.17
OC-29				
OC-30				
OC-31	20.74	5.88	62.80	20.17

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

OIL SPRINGS RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V (i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
OS-1	LD 2513	309	10	20	707	315	12	45	683	335	11	47	613
OS-2	LD 2524	309	10	25	758	315	12	48	731	335	11	50	547
OS-3	LD 2694	309	10	30	748	315	12	50	715	335	11	54	507
OS-4	LD 2753	309	10	40	734	315	12	53	708	335	11	56	587
OS-5	LD 2934	309	10	45	753	315	12	55	733	335	11	59	619
OS-6	LD 2882	309	10	50	756	315	12	59	743	335	12	2	718
OS-7	LD 2670	309	10	55	738	315	13	3	729	335	12	5	649
OS-8	LD 2584	309	11	0	753	315	13	5	700	335	12	7	426
OS-9	LD 2932	309	11	35	731	315	12	22	701	335	11	29	630
OS-10	LD 2668	309	11	40	762	315	12	25	724	335	11	32	668
OS-11	LD 2671	309	11	50	761	315	12	27	743	335	11	35	610
OS-12	LD 2741	309	11	55	752	315	12	30	745	335	11	37	716
OS-13	LD 2825	309	12	0	760	315	12	33	742	335	11	39	688
OS-14	LD 2302	309	12	5	748	315	12	37	715	335	11	41	565
OS-15	LD 2478	309	12	10	764	315	12	40	738	335	11	43	658
OS-16	LD 2532	309	10	42	760	315	11	40	754	335	13	31	748
OS-17	LD 3130	309	10	52	752	315	11	45	742	335	13	30	733
OS-18	LD 2717	309	10	58	747	315	11	47	673	335	13	24	542
OS-19	LD 2623	309	11	2	764	315	11	49	710	335	13	21	350
OS-20	LD 2737	309	11	7	746	315	11	52	701	335	13	25	543
OS-21	LD 2751	309	11	11	759	315	11	55	744	335	13	22	620
OS-22	LD 2542	309	11	16	753	315	11	59	702	335	13	28	636
OS-23	LD 2497	309	11	21	740	315	11	57	708	335	13	19	521
OS-24	LD 2058	309	12	5	755	315	12	3	728	335	13	27	649
OS-25	LD 2709	309	12	10	756	315	12	6	689	335	13	18	468
OS-26	LD 2983	309	12	14	758	315	12	9	729	335	13	20	636
OS-27	LD 2397	309	12	11	731	315	12	11	709	335	13	23	650
OS-28	LD 2666	309	12	36	759	315	13	15	672	335	12	25	129
OS-29	LD 2761	309	12	41	760	315	13	18	698	335	12	29	508
OS-30	LD 2432	309	12	46	759	315	13	21	720	335	12	33	629
OS-31	LD 2439	309	12	35	760	315	13	28	695	335	12	38	490
OS-32	LD 2495	309	12	40	760	315	13	32	710	335	12	45	610
OS-33	LD 2484	309	12	45	763	315	13	35	687	335	12	49	566

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

OIL SPRINGS RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
OS-1	106.61	6.10	98.81	26.06
OS-2	118.14	6.10	225.28	26.06
OS-3	145.62	6.10	260.01	26.06
OS-4	114.77	6.09	155.84	26.05
OS-5	87.10	6.09	140.56	26.05
OS-6	55.68	6.09	37.50	26.05
OS-7	38.07	6.09	92.34	26.05
OS-8	236.10	6.09	358.75	26.05
OS-9	134.36	6.03	105.82	26.00
OS-10	169.21	6.03	97.11	25.99
OS-11	78.76	6.03	159.09	25.99
OS-12	29.27	6.02	35.53	25.99
OS-13	78.83	6.02	73.63	25.99
OS-14	147.47	6.02	195.37	25.98
OS-15	114.93	6.02	110.01	25.98
OS-16	24.61	6.04	10.16	26.12
OS-17	42.73	6.04	17.52	26.11
OS-18	335.42	6.03	219.09	26.10
OS-19	241.88	6.03	459.45	26.10
OS-20	202.19	6.03	216.98	26.10
OS-21	65.21	6.03	145.48	26.09
OS-22	229.18	6.03	121.86	26.09
OS-23	143.24	6.03	235.59	26.08
OS-24	120.29	6.00	110.04	26.06
OS-25	304.00	6.00	313.07	26.05
OS-26	129.32	6.00	127.28	26.05
OS-27	98.32	6.00	83.92	26.05
OS-28	394.43	6.03	734.17	25.99
OS-29	279.16	6.03	272.04	25.99
OS-30	174.14	6.02	136.22	25.99
OS-31	292.39	6.04	292.47	26.00
OS-32	223.82	6.04	157.96	26.00
OS-33	342.68	6.03	209.73	26.00

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

OIL SPRINGS RADON CONCENTRATIONS - (Incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
OS-1	106.61	6.10	96.44	19.96
OS-2	118.14	6.10	258.07	19.96
OS-3	145.62	6.10	295.02	19.96
OS-4	114.77	6.09	168.39	19.96
OS-5	87.10	6.09	156.88	19.96
OS-6	55.68	6.09	31.95	19.96
OS-7	38.07	6.09	108.90	19.96
OS-8	236.10	6.09	396.37	19.96
OS-9	134.36	6.03	97.20	19.96
OS-10	169.21	6.03	75.33	19.96
OS-11	78.76	6.03	183.35	19.96
OS-12	29.27	6.02	37.42	19.96
OS-13	78.83	6.02	72.06	19.96
OS-14	147.47	6.02	209.87	19.96
OS-15	114.93	6.02	108.54	19.96
OS-16	24.61	6.04	5.82	20.08
OS-17	42.73	6.04	9.93	20.07
OS-18	335.42	6.03	184.20	20.07
OS-19	241.88	6.03	525.25	20.06
OS-20	202.19	6.03	221.49	20.06
OS-21	65.21	6.03	169.62	20.06
OS-22	229.18	6.03	89.63	20.06
OS-23	143.24	6.03	263.39	20.06
OS-24	120.29	6.00	106.99	20.06
OS-25	304.00	6.00	315.98	20.05
OS-26	129.32	6.00	126.69	20.05
OS-27	98.32	6.00	79.62	20.05
OS-28	394.43	6.03	838.31	19.97
OS-29	279.16	6.03	270.02	19.97
OS-30	174.14	6.02	124.80	19.97
OS-31	292.39	6.04	292.66	19.97
OS-32	223.82	6.04	138.09	19.97
OS-33	342.68	6.03	169.63	19.97

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93 **SOIL GAS RADON CONCENTRATIONS**

TERMINUS NORTH RAW DATA

Sample #	Electret	Day	Time Hrs	Minutes	V(i)	Day	Time Hrs	Minutes	V(2)	Day	Time Hrs	Minutes	V(3)
TN-1	LD 3109	309	9	25	748	317	8	50	738	333	14	59	688
TN-2	LD 2530	309	9	15	759	317	8	51	746	333	15	2	669
TN-3	LD-2839	309	9	10	760	317	8	53	732	333	15	4	641
TN-4	LD 2629	309	9	5	753	317	8	55	699	333	15	8	646
TN-5	LD 2700	309	9	2	761	317	8	58	710	333	15	10	674
TN-6	LD 2669	309	9	0	763	317	9	0	721	333	15	13	707
TN-7	LD 1989	309	8	55	756	317	9	3	706	333	15	16	701
TN-8	LD 2300	309	8	50	719	317	9	6	666	333	15	18	604
TN-9	LD 2678	309	8	49	753	317	9	9	735	333	15	20	703
TN-10	LD 2444	309	8	55	758	317	9	12	738	333	15	23	699
TN-11	LD 2458	309	8	59	752	317	9	15	718	333	15	27	685
TN-12	LD 2580	309	9	4	750	317	9	18	689	333	15	30	662
TN-13	LD 3875	309	9	8	748	317	9	20	639	333	15	32	348
TN-14	LD 2658	309	9	12	755	317	9	23	609	333	15	35	245
TN-15	LD 2876	309	9	18	759	317	9	27	638	333	15	37	218
TN-16	LD 3167	309	9	21	735	317	9	30	689	333	15	40	519

AURORA ENVIRONMENTAL SURVEYS LIMITED

SOIL GAS RADON CONCENTRATIONS

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

TERMINUS NORTH RADON CONCENTRATIONS - Average
(from date of deployment)
(gamma corrected for 19.13 uR/hr)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
TN-1	31.83	7.98	65.70	24.23
TN-2	41.88	7.98	99.80	24.24
TN-3	93.02	7.99	133.31	24.25
TN-4	182.70	7.99	119.65	24.25
TN-5	171.75	8.00	96.21	24.26
TN-6	140.66	8.00	60.72	24.26
TN-7	168.43	8.01	59.72	24.26
TN-8	181.02	8.01	130.46	24.27
TN-9	58.82	8.01	54.07	24.27
TN-10	65.54	8.01	64.22	24.27
TN-11	113.55	8.01	73.50	24.27
TN-12	206.72	8.01	97.70	24.27
TN-13	374.70	8.01	479.09	24.27
TN-14	504.78	8.01	622.70	24.27
TN-15	415.57	8.01	663.68	24.26
TN-16	155.81	8.01	250.24	24.26

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

TERMINUS NORTH (incremental)

Sample #	(1) Rn pCi/L	Days	(2) Rn pCi/L	Days
TN-1	31.83	7.98	82.31	16.26
TN-2	41.88	7.98	128.24	16.26
TN-3	93.02	7.99	153.13	16.26
TN-4	182.70	7.99	88.67	16.26
TN-5	171.75	8.00	59.07	16.26
TN-6	140.66	8.00	21.38	16.26
TN-7	168.43	8.01	6.19	16.26
TN-8	181.02	8.01	105.57	16.26
TN-9	58.82	8.01	51.73	16.26
TN-10	65.54	8.01	63.57	16.26
TN-11	113.55	8.01	53.77	16.26
TN-12	206.72	8.01	44.00	16.26
TN-13	374.70	8.01	531.28	16.26
TN-14	504.78	8.01	682.51	16.26
TN-15	415.57	8.01	787.62	16.26
TN-16	155.81	8.01	296.84	16.26

APPENDIX III

Radon Emanation Potential
(Apparent Radium)
Uranium and Radium Assays

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CONTROL AREA #1**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/L	Bq/g
CA1-1	SJ 2671	30.5553	1.5	37.19	57.58	20.39	523	446	9.34	1.3583	.3649	.6230	623	.023
CA1-2	SJ 2769	30.8009	1.5	37.19	57.58	20.39	605	525	9.39	1.3583	.3773	.6214	621	.023
CA1-3	SJ 2619	30.5941	1.5	37.19	57.58	20.39	593	501	11.04	1.3583	.3745	.7353	735	.027
CA1-4	SJ 2782	30.7556	1.5	37.19	57.58	20.39	573	535	3.96	1.3583	.3756	.2621	262	.010
CA1-5	SJ 2687	30.7064	1.5	37.19	57.58	20.39	642	547	11.20	1.3583	.3819	.7429	743	.027
CA1-6	SJ 2702	30.9762	1.5	37.19	57.58	20.39	653	556	11.40	1.3583	.3834	.7500	750	.028
CA1-7	SJ 2694	30.7591	1.5	37.19	57.58	20.39	645	552	10.92	1.3583	.3825	.7233	723	.027
CA1-8	SI 9689	30.9941	1.5	37.19	57.58	20.39	605	528	9.00	1.3583	.3775	.5914	591	.022
CA1-9	SI 9682	30.5863	1.5	37.19	57.58	20.39	614	530	9.88	1.3583	.3784	.6583	658	.024
CA1-10	SI 9821	30.7279	1.5	37.19	57.58	20.39	594	491	12.51	1.3583	.3738	.8293	829	.031
CA1-11	SI 9881	30.2151	1.5	37.2	57.58	20.38	622	529	11.04	1.3585	.3789	.7444	744	.028
CA1-12	SI 9720	30.6415	1.5	37.2	57.58	20.38	614	533	9.49	1.3585	.3786	.6312	631	.023
CA1-13	SI 9904	30.3112	1.5	37.2	57.58	20.38	609	531	9.12	1.3585	.3781	.6130	613	.023
CA1-14	SI 9870	30.1307	1.5	37.2	57.58	20.38	636	543	10.97	1.3585	.3811	.7419	742	.027
CA1-15	SJ 2764	30.5806	1.5	37.2	57.58	20.38	630	539	10.74	1.3585	.3803	.7154	715	.026
CA1-16	SJ 2759	30.8285	1.5	37.2	57.58	20.38	628	541	10.22	1.3585	.3803	.6755	675	.025
CA1-17	SJ 2722	30.6571	1.5	37.2	57.58	20.38	647	578	7.80	1.3585	.3846	.5183	518	.019
CA1-18	SI 9887	30.7674	1.5	37.2	57.68	20.48	455	382	9.04	1.3564	.3547	.5979	598	.022
CA1-19	SI 9839	30.8641	1.5	37.2	57.68	20.48	472	391	10.08	1.3564	.3568	.6645	665	.025
CA1-20	SI 9776	30.6547	1.5	37.2	57.68	20.48	613	538	8.66	1.3564	.3789	.5747	575	.021
CA1-21	SI 9737	30.7179	1.5	37.22	57.69	20.47	623	547	8.75	1.3566	.3804	.5800	580	.021
CA1-22	SI 9780	30.5536	1.5	37.22	57.69	20.47	618	555	7.08	1.3566	.3806	.4716	472	.017
CA1-23	SI 9797	30.6856	1.5	37.22	57.69	20.47	665	608	6.17	1.3566	.3883	.4088	409	.015
CA1-24	SI 9782	30.4349	1.5	37.22	57.69	20.47	604	546	6.47	1.3566	.3789	.4328	433	.016
CA1-25	SI 9842	30.4827	1.5	37.22	57.69	20.47	555	507	5.30	1.3566	.3721	.3536	354	.013
CA1-26	SI 9683	91.0953	1.5	57.76	78.62	20.86	521	304	28.40	1.3484	.3538	.6305	630	.023
CA1-27	SI 9764	30.3995	1.5	37.22	57.69	20.47	568	509	6.72	1.3566	.3732	.4496	450	.017
CA1-28	SI 9683	30.2041	1.5	37.22	57.69	20.47	601	520	9.50	1.3566	.3766	.6401	640	.024
CA1-29	SI 9799	30.4726	1.5	37.22	57.69	20.47	634	563	8.06	1.3566	.3825	.5384	538	.020
CA1-30	SI 9781	30.2811	1.5	37.23	57.72	20.49	649	568	9.29	1.3562	.3840	.6240	624	.023
CONT. 1	SI 9820		1.5	37.22	57.72	20.5	486	474	.60	1.3560	.3642			
CONT. 2	SI 9670		1.5	37.22	57.72	20.5	625	614	.39	1.3560	.3857			
CONT. 3	SI 9831		1.5	37.23	57.73	20.5	533	521	.57	1.3560	.3715			

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CONTROL AREA #2**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
CA2-1	SI 9824	30.9111	1.5	37.23	57.73	20.5	667	602	7.17	1.3560	.3880	.4715	472	.017
CA2-2	SI 9802	30.6116	1.5	37.23	57.73	20.5	646	581	7.23	1.3560	.3848	.4807	481	.018
CA2-3	SI 9793	30.1762	1.5	37.23	57.73	20.5	611	559	5.66	1.3560	.3804	.3817	382	.014
CA2-4	SI 9666	24.3768	1.5	317.4	339.62	22.22	754	700	5.04	1.3224	.4023	.4098	410	.015
CA2-5	SI 9658	24.1787	1.5	317.4	339.62	22.22	739	673	6.44	1.3224	.3990	.5282	528	.020
CA2-6	SI 9890	24.5964	1.5	317.4	339.62	22.22	761	694	6.49	1.3224	.4023	.5233	523	.019
CA2-7	SI 9715	23.7613	1.5	317.4	339.62	22.22	735	680	5.19	1.3224	.3993	.4336	434	.016
CA2-8	SI 9844	25.1207	1.5	317.41	339.62	22.21	737	674	6.10	1.3226	.3989	.4821	482	.018
CA2-9	SI 9697	25.8454	1.5	317.41	339.62	22.21	744	688	5.29	1.3226	.4006	.4060	406	.015
CA2-10	SI 9856	27.5586	1.5	317.41	339.62	22.21	748	668	8.01	1.3226	.3993	.5769	577	.021
CA2-11	SI 9804	27.2277	1.5	317.42	339.7	22.28	755	677	7.73	1.3214	.4006	.5630	563	.021
CA2-12	SI 9782	28.4941	1.5	317.46	339.7	22.24	733	627	11.06	1.3221	.3950	.7697	770	.028
CA2-13	SI 9793	27.1281	1.5	317.46	339.7	22.24	755	671	8.43	1.3221	.4001	.6166	617	.023
CA2-14	SI 9712	20.8171	1.5	317.46	339.7	22.24	736	676	5.76	1.3221	.3990	.5483	548	.020
CA2-15	SI 9901	22.5626	1.5	317.42	339.7	22.28	752	679	7.18	1.3214	.4005	.6304	630	.023
CA2-16	SI 9695	25.9322	1.5	317.46	339.71	22.25	765	698	6.47	1.3219	.4030	.4945	495	.018
CA2-17	SI 9696	24.2056	1.5	317.46	339.71	22.25	742	674	6.65	1.3219	.3993	.5446	545	.020
CA2-18	SI 9756	23.7607	1.5	317.46	339.71	22.25	732	663	6.79	1.3219	.3977	.5668	567	.021
CA2-19	SI 9753	28.2782	1.5	317.46	339.71	22.25	724	612	11.80	1.3219	.3932	.8272	827	.031
CA2-20	SI 9792	29.4209	1.5	317.46	339.71	22.25	741	651	9.17	1.3219	.3975	.6181	618	.023
CA2-21	SI 9740	25.0624	2	317.46	339.71	22.25	724	654	6.93	1.3219	.3964	.7311	731	.027
CA2-22	SI 9784	29.8464	2	317.46	339.71	22.25	760	681	7.84	1.3219	.4013	.6947	695	.026
CA2-23	SI 9694	25.8185	2	317.46	339.71	22.25	752	695	5.37	1.3219	.4017	.5500	550	.020
CA2-24	SI 9823	24.9529	2	317.47	339.71	22.24	746	691	5.16	1.3221	.4009	.5470	547	.020
CA2-25	SI 9794	30.5225	2	317.47	339.71	22.24	738	660	7.81	1.3221	.3979	.6764	676	.025
CA2-26	SI 9898	28.3158	2	317.47	339.71	22.24	738	667	7.01	1.3221	.3985	.6542	654	.024
CA2-27	SI 9900	29.4341	2	317.47	339.71	22.24	740	678	5.97	1.3221	.3995	.5366	537	.020
CA2-28	SI 9831	20.6971	2	317.45	339.72	22.27	740	688	4.83	1.3215	.4003	.6166	617	.023
CA2-29	SI 9867	25.6904	2	317.45	339.72	22.27	739	678	5.85	1.3215	.3994	.6021	602	.022
CA2-30	SI 9893	29.3482	2	317.45	339.72	22.27	743	680	6.07	1.3215	.3999	.5466	547	.020

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CONTROL AREA #3**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
CA3-1	SI 9736	22.5674	2	316.62	340.74	24.12	752	705	3.84	1.2916	.4025	.4391	439	.016
CA3-2	SI 9868	22.6842	2	316.62	340.74	24.12	732	686	3.77	1.2916	.3995	.4291	429	.016
CA3-3	SI 9883	21.0069	2	316.62	340.74	24.12	748	708	3.12	1.2916	.4024	.3831	383	.014
CA3-4	SI 9749	22.3494	2	316.62	340.74	24.12	751	699	4.36	1.2916	.4020	.5037	504	.019
CA3-5	SI 9879	23.8765	2	316.62	340.74	24.12	730	680	4.19	1.2916	.3989	.4535	453	.017
CA3-6	SI 9884	22.2351	2	316.62	342.81	26.19	763	707	4.29	1.2639	.4035	.4881	488	.018
CAS-7	SI 9737	23.6861	2	316.62	342.81	26.19	752	696	4.32	1.2639	.4018	.4606	461	.017
CA3-8	SI 9861	23.4715	2	316.63	342.81	26.18	744	684	4.72	1.2640	.4003	.5084	508	.019
CA3-9	SI 9780	22.1111	2	316.63	342.81	26.18	743	683	4.72	1.2640	.4001	.5399	540	.020
CA3-10	SI 9709	23.0883	2	316.63	342.81	26.18	758	702	4.31	1.2640	.4027	.4715	471	.017
CA3-11	SI 9873	21.8096	2	316.63	342.81	26.18	747	692	4.23	1.2640	.4011	.4905	491	.018
CA3-12	SI 9886	23.8512	2	316.63	342.81	26.18	742	683	4.63	1.2640	.4000	.4905	491	.018
CA3-13	SI 9880	23.0237	2	316.64	342.81	26.17	754	697	4.41	1.2641	.4020	.4845	484	.018
CA3-14	SI 9797	23.1227	2	316.64	342.81	26.17	747	694	4.04	1.2641	.4013	.4419	442	.016
CA3-15	SI 9814	22.2821	2	316.64	342.81	26.17	724	672	3.99	1.2641	.3978	.4527	453	.017
CA3-16	SI 9759	23.7621	2	316.64	340.75	24.11	758	704	4.55	1.2918	.4029	.4951	495	.018
CA3-17	SI 9734	23.7878	1.5	316.44	339.61	23.17	767	696	6.60	1.3063	.4030	.5436	544	.020
CA3-18	SI 9707	22.3948	1.5	316.44	339.61	23.17	742	675	6.23	1.3063	.3994	.5455	545	.020
CA3-19	SI 9825	21.1161	1.5	316.44	339.61	23.17	757	689	6.30	1.3063	.4016	.5847	585	.022
CA3-20	SI 9743	21.4966	1.5	316.44	339.61	23.17	747	703	3.72	1.3063	.4020	.3390	339	.013
CA3-21	SI 9838	22.5516	1.5	316.45	339.61	23.16	736	674	5.71	1.3065	.3989	.4958	496	.018
CA3-22	SI 9703	22.7367	1.5	316.46	339.61	23.15	744	671	6.89	1.3066	.3993	.5941	594	.022
CA3-23	SI 9982	23.2525	1.5	316.46	339.61	23.15	745	669	7.22	1.3066	.3992	.6085	608	.023
CA3-24	SI 9822	20.2761	1.5	316.47	339.62	23.15	760	695	5.97	1.3066	.4023	.5774	577	.021
CA3-25	SI 9895	23.7041	1.5	316.47	339.62	23.15	743	662	7.77	1.3066	.3985	.6429	643	.024
CA3-26	SI 9766	23.8831	1.5	316.47	339.62	23.15	744	670	7.00	1.3066	.3992	.5746	575	.021
CA3-27	SI 9693	24.1165	1.5	316.47	339.62	23.15	751	678	6.87	1.3066	.4003	.5584	558	.021
CA3-28	SI 9860	23.5591	1.5	316.48	339.62	23.14	747	667	7.66	1.3068	.3992	.6369	637	.024
CA3-29	SI 9789	23.5766	1.5	316.48	339.62	23.14	762	678	8.04	1.3068	.4012	.6687	669	.025
CA3-30	SI 9859	24.0736	1.5	316.48	339.62	23.14	746	662	8.10	1.3068	.3987	.6594	659	.024

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CHATHAM GAS FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
CH-1	SJ 2566	30.5782	1.5	345.48	372.67	27.19	650	602	3.56	1.2522	.3867	.2186	219	.008
CH-2	SJ 2688	30.7216	1.5	345.48	372.67	27.19	634	582	3.98	1.2522	.3839	.2431	243	.009
CH-3	SJ 2609	30.8863	1.5	345.48	372.67	27.19	692	633	4.53	1.2522	.3923	.2752	275	.010
CH-4	SJ 2680	30.3797	1.5	345.5	372.67	27.17	655	585	5.67	1.2524	.3858	.3508	351	.013
CH-5	SI 9880	30.9807	1.5	345.5	372.67	27.17	695	629	5.19	1.2524	.3922	.3145	315	.012
CH-6	SI 9886	30.7495	1.5	345.5	372.67	27.17	684	628	4.26	1.2524	.3913	.2603	260	.010
CH-7	SI 9709	30.7878	1.5	345.5	372.67	27.17	700	640	4.61	1.2524	.3935	.2811	281	.010
CH-8	SI 9814	30.5839	1.5	345.5	372.67	27.17	666	604	4.87	1.2524	.3881	.2994	299	.011
CH-9	SI 9873	30.8315	1.5	345.5	372.67	27.17	691	618	5.86	1.2524	.3911	.3573	357	.013
CH-10	SI 9797	30.3017	1.5	345.5	372.67	27.17	693	666	1.51	1.2524	.3949	.0937	94	.003
CH-11	SI 9780	30.9419	1.5	345.5	372.67	27.17	682	619	4.93	1.2524	.3905	.2995	299	.011
CH-12	SI 9737	30.1251	1.5	345.5	372.67	27.17	692	621	5.67	1.2524	.3914	.3536	354	.013
CH-13	SI 9670	30.9767	1.5	345.51	372.68	27.17	697	625	5.75	1.2524	.3921	.3489	349	.013
CH-14	SI 9743	30.2239	2	344.5	372.44	27.94	702	658	2.98	1.2440	.3950	.2454	245	.009
CH-15	SI 9734	30.6074	2	344.52	372.44	27.92	696	634	4.65	1.2443	.3927	.3780	378	.014
CH-16	SI 9825	30.0011	2	344.5	372.44	27.94	679	625	3.94	1.2440	.3907	.3268	327	.012
CH-17	SI 9707	29.6942	2	344.5	372.44	27.94	671	626	3.12	1.2440	.3902	.2616	262	.010
CH-18	SI 9772	30.3731	2	344.52	372.44	27.92	617	563	4.07	1.2443	.3812	.3333	333	.012
CH-19	SI 9748	30.3464	2	344.52	372.44	27.92	653	608	3.15	1.2443	.3874	.2587	259	.010
CH-20	SI 9895	30.9692	2	344.52	372.44	27.92	662	617	3.14	1.2443	.3888	.2523	252	.009
CH-21	SI 9838	30.1001	2	344.5	372.45	27.95	672	620	3.77	1.2439	.3898	.3114	311	.012
CH-22	SI 9835	30.8944	2	344.58	372.45	27.87	635	578	4.32	1.2448	.3837	.3485	348	.013
CH-23	SI 9721	30.7526	2	344.58	372.45	27.87	624	577	3.40	1.2448	.3828	.2753	275	.010
CH-24	SI 9826	30.9205	2	344.58	372.45	27.87	634	586	3.48	1.2448	.3842	.2799	280	.010
CH-25	SI 9845	30.3407	2	344.58	372.45	27.87	635	591	3.10	1.2448	.3847	.2542	254	.009

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CLEARVILLE FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn emanation potential pCi/g	Rn emanation potential pCi/kg	Bq/g
CL-1	SI 9890	30.4551	2	28.41	48.46	20.05	606	586	1.61	1.3658	.3821	.1440	144	.005
CL-2	SI 9715	30.5497	2	28.41	48.46	20.05	592	578	.83	1.3658	.3804	.0742	74	.003
CL-3	SI 9712	30.2194	2	28.41	48.46	20.05	586	569	1.23	1.3658	.3792	.1112	111	.004
CL-4	SJ 2692	30.4981	2	28.41	48.46	20.05	615	580	3.56	1.3658	.3823	.3189	319	.012
CL-5	SI 9882	30.3787	2	28.41	48.46	20.05	608	581	2.52	1.3658	.3819	.2267	227	.008
CL-6	SI 9822	30.3925	2	28.41	48.46	20.05	627	594	3.28	1.3658	.3843	.2945	295	.011
CL-7	SI 9844	30.8835	2	28.41	48.46	20.05	592	582	.30	1.3658	.3807	.0269	27	.001
CL-8	SI 9697	30.7468	2	28.41	48.46	20.05	608	572	3.71	1.3658	.3812	.3292	329	.012
CL-9	SI 9722	30.6751	2	28.41	48.46	20.05	522	499	2.10	1.3658	.3689	.1874	187	.007
CL-10	SI 9806	30.5939	2	28.42	48.46	20.04	515	479	3.89	1.3660	.3668	.3475	348	.013
CL-11	SJ 2521	30.4167	2	28.44	48.46	20.02	543	508	3.70	1.3665	.3712	.3328	333	.012
CL-12	SI 9847	30.4748	2	28.44	48.46	20.02	562	531	3.13	1.3665	.3745	.2807	281	.010
CL-13	SI 9899	30.3122	2	28.44	48.46	20.02	562	541	1.79	1.3665	.3752	.1614	161	.006
CL-14	SI 9655	30.3052	2	28.44	48.46	20.02	517	457	7.20	1.3665	.3653	.6492	649	.024
CL-15	SI 9775	30.2597	2	28.45	48.46	20.01	543	507	3.84	1.3667	.3712	.3470	347	.013
CL-16	SI 9718	30.8346	2	28.45	48.46	20.01	538	520	1.41	1.3667	.3718	.1254	125	.005
CL-17	SI 9703	30.2431	2	28.45	48.46	20.01	610	592	1.34	1.3667	.3829	.1215	121	.004
CL-18	SI 9856	30.2325	2	28.45	48.46	20.01	577	549	2.71	1.3667	.3770	.2447	245	.009
CL-19	SI 9716	30.6665	2	28.45	48.47	20.02	603	587	1.09	1.3665	.3819	.0969	97	.004
CL-20	SI 9726	30.3741	2	28.45	48.47	20.02	621	605	1.07	1.3665	.3847	.0964	96	.004
CL-21	SJ 2529	30.4059	2	28.45	48.47	20.02	605	584	1.74	1.3665	.3819	.1565	157	.006
CL-22	SJ 2543	30.7701	2	28.45	48.51	20.06	547	527	1.67	1.3656	.3730	.1480	148	.005
CL-23	SJ 2614	30.6323	2	28.46	48.59	20.13	594	576	1.35	1.3640	.3804	.1198	120	.004
CL-24	SJ 2753	30.7946	2	28.46	48.59	20.13	567	551	1.11	1.3640	.3764	.0980	98	.004
CL-25	SJ 2767	30.8965	2	28.46	48.59	20.13	582	559	2.02	1.3640	.3782	.1780	178	.007
CL-26	SJ 2700	30.0116	2	28.46	48.59	20.13	635	616	1.44	1.3640	.3866	.1305	131	.005
CL-27	SJ 2679	30.8626	2	28.46	48.59	20.13	620	598	1.84	1.3640	.3841	.1626	163	.006
CL-28	SJ 2707	30.4767	2	28.46	48.59	20.13	629	606	1.96	1.3640	.3854	.1754	175	.006
CL-29	SJ 2552	30.5627	2	28.46	48.59	20.13	639	619	1.56	1.3640	.3872	.1393	139	.005
CL-30	SI 9752	30.5096	2	28.47	48.59	20.12	559	542	1.25	1.3643	.3751	.1115	112	.004
CL-31	SI 9790	30.8142	2	28.47	48.6	20.13	555	526	2.85	1.3640	.3735	.2524	252	.009
CL-31AD	SI 9841	30.2801	1.5	30.67	48.5	17.83	577	546	3.61	1.4228	.3768	.2544	254	.009
CL-32	SI 9805	30.6921	2	28.48	48.6	20.12	541	520	1.80	1.3643	.3720	.1600	160	.006
CL-32AD	SI 9873	30.6063	1.5	30.67	48.5	17.83	617	594	2.36	1.4228	.3835	.1644	164	.006
CL-33	SI 9671	30.4501	2	28.48	48.6	20.12	517	491	2.51	1.3643	.3679	.2246	225	.008
CL-33AD	SI 9753	30.5727	1.5	30.67	48.5	17.83	451	417	4.33	1.4228	.3571	.3025	303	.011
CL-34	SI 9729	30.6074	2	28.48	48.6	20.12	594	570	2.13	1.3643	.3799	.1902	190	.007
CL-34AD	SI 9814	30.8755	1.5	30.67	48.5	17.83	600	579	2.09	1.4228	.3811	.1441	144	.005
CL-35	SI 9878	30.9908	2	28.48	48.6	20.12	450	432	1.49	1.3643	.3582	.1313	131	.005
CL-35AD	SI 9709	30.2571	1.5	30.67	48.5	17.83	638	617	2.04	1.4228	.3869	.1438	144	.005
CL-36	SI 9903	30.5208	2	28.48	48.52	20.04	525	502	2.10	1.3660	.3694	.1881	188	.007

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **CLEARVILLE FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn emanation potential pCi/g	Rn emanation potential pCi/kg	Bq/g
CL-37	SI 9673	30.7679	2	28.48	48.52	20.04	575	552	2.04	1.3660	.3771	.1810	181	.007
CL-38	SI 9884	30.5569	2	28.48	48.52	20.04	579	551	2.70	1.3660	.3773	.2412	241	.009
CL-39	SI 9861	30.4081	2	28.49	48.52	20.03	573	543	2.98	1.3663	.3762	.2674	267	.010
CL-40	SI 9766	30.8764	2	28.5	48.52	20.02	543	514	2.89	1.3665	.3717	.2559	256	.009
CL-41	SI 9693	30.1139	2	28.5	48.52	20.02	566	548	1.39	1.3665	.3761	.1257	126	.005
CL-42	SI 9773	30.5153	2	28.53	48.52	19.99	533	508	2.37	1.3672	.3705	.2124	212	.008
CL-43	SI 9807	30.2987	2	28.53	48.52	19.99	587	569	1.37	1.3672	.3793	.1235	123	.005
CL-44	SI 9879	30.5025	2	28.53	48.52	19.99	559	537	1.93	1.3672	.3747	.1732	173	.006
CL-45	SI 9757	30.9408	2	28.53	48.52	19.99	512	490	1.99	1.3672	.3675	.1758	176	.007
CLE-1	SI 9802	30.3616	1.5	347.63	372.51	24.88	695	646	4.00	1.2808	.3936	.2530	253	.009
CLE-2	SI 9824	30.505	1.5	347.63	372.51	24.88	719	667	4.26	1.2808	.3970	.2682	268	.010
CLE-3	SI 9781	30.3425	1.5	347.63	372.51	24.88	688	650	2.88	1.2808	.3933	.1822	182	.007
CLE-4	SI 9799	30.4339	1.5	347.63	372.51	24.88	706	637	6.04	1.2808	.3937	.3812	381	.014
CLE-5	SI 9683	30.3618	1.5	347.63	372.51	24.88	647	601	3.78	1.2808	.3864	.2391	239	.009
CLE-6	SI 9764	30.7281	1.5	347.63	372.51	24.88	660	586	6.69	1.2808	.3862	.4186	419	.015
CLE-7	SI 9667	30.5479	1.5	347.63	372.51	24.88	622	584	2.98	1.2808	.3832	.1875	187	.007
CLE-8	SI 9842	30.8314	1.5	347.63	372.51	24.88	618	555	5.65	1.2808	.3806	.3519	352	.013

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **COVENY FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
CO-1	SI 9657	30.2041	1.5	318.64	342.49	23.85	723	652	6.51	1.2957	.3962	.4188	419	.015
CO-2	SI 9841	30.4941	1.5	318.64	342.49	23.85	722	653	6.30	1.2957	.3962	.4013	401	.015
CO-3	SI 9909	25.5231	1.5	318.64	342.49	23.85	747	675	6.55	1.2957	.3998	.4984	498	.018
CO-4	SI 9678	29.3671	1.5	318.64	342.49	23.85	736	665	6.47	1.2957	.3982	.4282	428	.016
CO-5	SI 9713	26.0347	1.5	318.64	342.49	23.85	757	685	6.52	1.2957	.4013	.4865	486	.018
CO-6	SI 9771	30.1191	1.5	318.64	342.49	23.85	726	658	6.18	1.2957	.3969	.3987	399	.015
CO-7	SI 9758	30.9042	1.5	318.64	342.49	23.85	760	686	6.72	1.2957	.4016	.4226	423	.016
CO-8	SI 9710	29.5429	1.5	318.65	342.49	23.84	761	676	7.89	1.2958	.4009	.5189	519	.019
CO-9	SI 9755	24.6896	1.5	318.65	342.49	23.84	741	679	5.50	1.2958	.3996	.4332	433	.016
CO-10	SI 9896	30.8747	1.5	318.65	342.49	23.84	743	687	4.86	1.2958	.4004	.3060	306	.011
CO-11	SI 9719	29.0122	1.5	318.65	342.49	23.84	743	657	8.06	1.2958	.3981	.5397	540	.020
CO-12	SI 9796	29.1713	1.5	318.65	342.49	23.84	748	671	7.08	1.2958	.3996	.4716	472	.017
CO-13	SI 9779	30.8152	1.5	318.65	342.5	23.85	734	687	3.92	1.2957	.3997	.2475	248	.009
CO-14	SI 9676	29.3197	1.5	318.65	342.5	23.85	748	603	14.41	1.2957	.3943	.9553	955	.035
CO-15	Si 9876	25.8341	1.5	318.65	342.5	23.85	729	645	7.89	1.2957	.3961	.5933	593	.022
CO-16	SI 9837	29.9964	1.5	318.65	342.5	23.85	754	682	6.53	1.2957	.4009	.4228	423	.016
CO-17	SI 9678	30.0923	1.5	318.65	342.5	23.85	738	668	6.36	1.2957	.3986	.4107	411	.015
CO-18	SI 9735	28.9434	1.5	318.66	342.5	23.84	749	677	6.54	1.2958	.4001	.4394	439	.016
CO-19	SI 9848	30.0228	1.5	318.66	342.5	23.84	727	644	7.79	1.2958	.3959	.5043	504	.019
CO-20	SI 9727	29.0438	1.5	318.66	342.5	23.84	766	715	4.29	1.2958	.4043	.2868	287	.011
CO-21	SI 9747	28.3296	1.5	318.66	342.5	23.84	734	656	7.23	1.2958	.3973	.4960	496	.018
CO-22	SI 9817	29.9702	1.5	318.67	342.51	23.84	735	650	7.98	1.2958	.3969	.5173	517	.019
CO-23	SI 9751	29.8827	1.5	318.67	342.51	23.84	749	694	4.74	1.2958	.4014	.3084	308	.011
CO-24	SI 9669	30.1762	1.5	318.67	342.51	23.84	741	683	5.08	1.2958	.3999	.3271	327	.012
CO-25	SI 9854	27.5441	1.5	318.67	342.51	23.84	758	682	6.94	1.2958	.4012	.4898	490	.018
CO-26	SI 9804	27.6748	1.5	318.67	342.51	23.84	738	671	6.04	1.2958	.3988	.4243	424	.016
CO-27	SI 9671	29.5172	1.5	318.67	342.51	23.84	720	641	7.38	1.2958	.3951	.4861	486	.018
CO-28	SI 9878	29.6866	1.5	318.67	342.51	23.84	660	570	8.80	1.2958	.3850	.5762	576	.021
CO-29	SI 9903	29.6418	1.5	318.67	342.51	23.84	765	684	7.45	1.2958	.4019	.4885	488	.018
CO-30	SI 9673	30.6902	1.5	318.67	342.51	23.84	749	684	5.80	1.2958	.4006	.3673	367	.014

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **DAWN GAS FIELDS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
DG-01	SI 9752	21.2585	1.5	315.95	339.57	23.62	715	616	9.67	1.2992	.3928	.8860	886	.033
DG-02	SI 9729	22.4215	1.5	315.95	339.57	23.62	761	643	11.53	1.2992	.3984	1.0025	1002	.037
DG-03	SI 9887	23.5726	1.5	315.96	339.57	23.61	758	669	8.41	1.2994	.4002	.6957	696	.026
DG-04	SI 9763	22.4366	1.5	315.96	339.57	23.61	751	627	12.24	1.2994	.3964	1.0636	1064	.039
DG-05	SI 9816	23.5861	1.5	315.96	339.57	23.61	764	628	13.49	1.2994	.3975	1.1144	1114	.041
DG-06	SI 9708	21.2739	1.5	315.96	339.57	23.61	746	639	10.41	1.2994	.3969	.9539	954	.035
DG-07	SI 9700	20.8653	1.5	315.96	339.57	23.61	651	543	10.96	1.2994	.3822	1.0239	1024	.038
DG-08	SI 9791	22.9214	1.5	315.96	339.57	23.61	729	618	10.93	1.2994	.3940	.9291	929	.034
DG-09	SI 9721	20.5218	1.5	315.96	339.57	23.61	746	624	12.05	1.2994	.3958	1.1444	1144	.042
DG-10	SI 9835	23.0951	1.5	315.96	339.58	23.62	754	637	11.46	1.2992	.3974	.9669	967	.036
DG-11	SI 9722	23.7108	1.5	315.96	339.58	23.62	754	620	13.32	1.2992	.3961	1.0945	1095	.040
DG-12	SI 9806	22.9369	1.5	315.96	339.58	23.62	730	647	7.86	1.2992	.3963	.6679	668	.025
DG-13	SI 9847	22.7011	1.5	315.96	339.58	23.62	731	653	7.32	1.2992	.3969	.6280	628	.023
DG-14	SI 9899	21.4415	1.5	315.97	339.58	23.61	739	657	7.73	1.2994	.3978	.7022	702	.026
DG-15	SI 9655	20.5634	1.5	315.97	339.58	23.61	766	627	13.80	1.2994	.3976	1.3083	1308	.048
DG-16	SI 9775	23.5788	1.5	315.97	339.58	23.61	744	645	9.55	1.2994	.3973	.7894	789	.029
DG-17	SI 9845	23.8641	1.5	315.97	339.58	23.61	757	636	11.89	1.2994	.3976	.9707	971	.036
DG-18	SI 9718	23.0181	1.5	316.43	339.58	23.15	738	633	10.45	1.3066	.3959	.8900	890	.033
DG-19	SI 9748	21.9097	1.5	316.43	339.58	23.15	742	654	8.55	1.3066	.3978	.7649	765	.028
DG-20	SI 9772	24.6313	1.5	316.43	339.58	23.15	733	618	11.59	1.3066	.3943	.9224	922	.034
DG-21	SI 9661	30.6371	2	348.75	371.54	22.79	658	551	11.24	1.3126	.3834	.9631	963	.036
DG-22	SI 9894	30.7198	2	348.75	371.54	22.79	672	552	12.69	1.3126	.3845	1.0842	1084	.040
DG-23	SI 9730	30.2586	2	348.75	371.54	22.79	657	510	15.96	1.3126	.3802	1.3848	1385	.051
DG-24	SI 9701	30.4491	2	348.75	371.54	22.79	674	573	10.47	1.3126	.3863	.9023	902	.033
DG-25	SI 9769	30.5992	2	348.75	371.55	22.80	651	525	13.50	1.3124	.3809	1.1584	1158	.043
DG-26	SI 9787	30.4152	2	348.75	371.55	22.80	678	537	15.11	1.3124	.3839	1.3036	1304	.048
DG-27	SI 9749	30.9811	2	348.75	371.55	22.80	700	559	14.96	1.3124	.3872	1.2678	1268	.047
DG-28	SI 9883	30.3396	2	348.75	371.55	22.80	706	558	15.74	1.3124	.3876	1.3618	1362	.050
DG-29	SI 9868	30.9611	2	348.75	371.55	22.80	686	576	11.45	1.3124	.3875	.9703	970	.036
DG-30	SI 9736	30.3345	2	348.75	371.56	22.81	698	585	11.73	1.3122	.3891	1.0146	1015	.038
DG-31	SI 9693	30.5775	2	348.75	371.56	22.81	677	566	11.60	1.3122	.3860	.9957	996	.037
DG-32	SI 9766	30.4084	2	348.75	371.56	22.81	669	543	13.39	1.3122	.3836	1.1560	1156	.043
DG-33	SI 9861	30.2171	2	348.75	371.56	22.81	683	574	11.34	1.3122	.3871	.9849	985	.036
DG-34	SI 9884	30.0073	2	348.75	371.56	22.81	707	579	13.41	1.3122	.3893	1.1727	1173	.043
DG-35	SI 9673	30.6283	2	348.75	371.56	22.81	648	575	7.32	1.3122	.3845	.6271	627	.023
DG-36	SI 9903	30.3317	2	348.75	371.56	22.81	682	527	16.72	1.3122	.3834	1.4466	1447	.054
DG-37	SI 9878	30.6865	2	348.75	371.56	22.81	567	451	12.79	1.3122	.3687	1.0937	1094	.040
DG-38	SI 9671	30.5804	2	348.76	371.56	22.80	642	520	13.08	1.3124	.3798	1.1230	1123	.042
DG-39	SI 9805	30.5877	2	348.76	371.57	22.81	668	542	13.40	1.3122	.3835	1.1497	1150	.043
DG-40	SI 9794	30.9895	1.5	36.42	57.73	31.31	548	436	13.35	1.3394	.3661	.8657	866	.032

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **DAWN GAS FIELDS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Bq/g
DG-41	SI 9761	30.3324	1.5	345.46	371.67	26.21	683	552	11.96	1.2636	.3854	.7476	748	.028
DG-42	SI 9820	30.6251	1.5	345.46	371.68	26.22	680	468	20.35	1.2635	.3787	1.2591	1259	.047
DG-43	SI 9725	30.5239	1.5	345.46	371.67	26.21	674	511	15.29	1.2636	.3815	.9497	950	.035
DG-44	SI 9893	30.7264	1.5	345.46	371.67	26.21	674	549	11.40	1.2636	.3845	.7032	703	.026
DG-45	SI 9867	30.7305	1.5	345.46	371.67	26.21	677	592	7.35	1.2636	.3880	.4535	453	.017
DG-46	SI 9865	30.7764	1.5	345.46	371.67	26.21	707	582	11.24	1.2636	.3896	.6921	692	.026
DG-47	SJ 2548	30.4113	1.5	345.46	371.67	26.21	692	588	9.20	1.2636	.3889	.5733	573	.021
DG-48	SJ 2551	30.7608	1.5	345.46	371.67	26.21	685	464	21.26	1.2636	.3788	1.3097	1310	.048
DG-49	SI 9897	30.6267	1.5	345.46	371.67	26.21	682	473	20.02	1.2636	.3792	1.2391	1239	.046
DG-50	SI 9839	30.1777	1.5	345.47	371.67	26.2	704	455	24.03	1.2637	.3795	1.5097	1510	.056
DG-1-0	SI 9794	30.0831	1.5	346.51	372.53	26.02	657	549	9.83	1.2660	.3832	.6203	620	.023
DG-2-0	SI 9831	30.3372	1.5	346.51	372.53	26.02	686	532	14.40	1.2660	.3841	.9016	902	.033
DG-3-0	SI 9900	30.8911	1.5	346.51	372.53	26.02	675	569	9.55	1.2660	.3861	.5868	587	.022
DG-4-0	SI 9898	30.9377	1.5	346.51	372.53	26.02	666	533	12.35	1.2660	.3826	.7582	758	.028
DG-5-0	SI 9823	29.8766	1.5	346.51	372.53	26.02	689	532	14.69	1.2660	.3843	.9340	934	.035
DG-6-0	SI 9694	30.5846	1.5	346.51	372.53	26.02	693	563	11.90	1.2660	.3870	.7391	739	.027
DG-7-0	SI 9784	30.3688	1.5	346.51	372.53	26.02	680	554	11.56	1.2660	.3853	.7229	723	.027
DG-8-0	SI 9740	30.7416	1.5	346.51	372.53	26.02	650	491	15.15	1.2660	.3782	.9360	936	.035
DG-9-0	SI 9792	30.4724	1.5	346.51	372.53	26.02	649	492	14.95	1.2660	.3782	.9317	932	.034
DG-10-0	SI 9753	30.3758	1.5	346.51	372.53	26.02	609	451	15.32	1.2660	.3719	.9578	958	.035
DG-11-0	SJ 2784	30.7964	1.5	346.51	372.53	26.02	681	552	11.86	1.2660	.3852	.7315	732	.027
DG-12-0	SI 9662	30.0731	1.5	346.52	372.53	26.01	649	558	8.12	1.2661	.3832	.5130	513	.019
DG-13-0	SI 9810	30.6452	1.5	346.52	372.53	26.01	660	547	10.33	1.2661	.3832	.6402	640	.024
DG-14-0	SI 9858	30.9259	1.5	346.54	372.53	25.99	674	576	8.75	1.2663	.3866	.5374	537	.020
DG-15-0	SI 9798	30.6242	1.5	346.54	372.53	25.99	657	519	12.94	1.2663	.3809	.8024	802	.030
DG-16-0	SI 9866	30.3211	1.5	346.54	372.53	25.99	676	561	10.47	1.2663	.3855	.6560	656	.024
DG-17-0	SI 9759	30.4647	1.5	346.54	372.53	25.99	703	516	17.72	1.2663	.3842	1.1051	1105	.041
DG-18-0	SI 9879	30.1981	1.5	346.54	372.53	25.99	680	559	11.06	1.2663	.3857	.6960	696	.026
DG-19-0	SI 9807	30.8892	1.5	346.54	372.53	25.99	671	587	7.34	1.2663	.3872	.4515	452	.017
DG-20-0	SI 9773	30.9354	1.5	346.54	372.53	25.99	675	533	13.25	1.2663	.3833	.8135	813	.030
Cont 1.5	SI 9854	0	1.5	348.76	371.54	22.78	681	668	.44	1.3127	.3942			
Cont 2	SJ 2642	0	1.5	348.76	371.56	22.8	695	680	.66	1.3124	.3962			

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **DOVER FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
DO-1	SJ 2617	30.4587	1.5	345.52	371.5	25.98	715	603	10.00	1.2665	.3918	.6236	624	.023
DO-2	SJ 2667	30.5967	1.5	345.52	371.5	25.98	703	650	4.17	1.2665	.3945	.2586	259	.010
DO-3	SJ 9904	30.9308	1.5	345.52	371.5	25.98	687	646	3.01	1.2665	.3929	.1849	185	.007
DO-4	SI 9821	30.4097	1.5	345.52	371.5	25.98	675	625	3.92	1.2665	.3904	.2451	245	.009
DO-5	SI 9881	30.1176	1.5	345.52	371.5	25.98	701	659	3.09	1.2665	.3950	.1947	195	.007
DO-6	SI 9720	30.5511	1.5	345.52	371.5	25.98	692	656	2.51	1.2665	.3941	.1561	156	.006
DO-7	SI 9870	30.6278	1.5	345.54	371.5	25.96	712	677	2.39	1.2667	.3973	.1482	148	.005
DO-8	SI 9776	30.3843	1.5	345.54	371.5	25.96	704	653	3.97	1.2667	.3948	.2483	248	.009
DO-9	SI 9783	30.8019	1.5	345.54	371.5	25.96	684	638	3.51	1.2667	.3921	.2167	217	.008
DO-10	SI 9786	30.8639	1.5	345.54	371.5	25.96	648	604	3.38	1.2667	.3867	.2079	208	.008
DO-11	SI 9676	30.3671	1.5	345.54	371.5	25.96	599	553	3.67	1.2667	.3790	.2296	230	.008
DO-12	SI 9866	30.7242	2	28.54	49.03	20.49	559	515	4.75	1.3562	.3730	.4195	419	.016
DO-13	SI 9798	30.8648	2	28.54	49.03	20.49	519	473	5.12	1.3562	.3667	.4497	450	.017
DO-14	SI 9858	30.5419	2	28.54	49.03	20.49	578	540	3.92	1.3562	.3764	.3483	348	.013
DO-15	SI 9810	30.8893	2	28.54	49.03	20.49	548	502	5.04	1.3562	.3712	.4428	443	.016
DO-16	SI 9662	30.3385	2	28.55	49.04	20.49	557	515	4.49	1.3562	.3728	.4016	402	.015
DO-17	SJ 2784	30.6857	2	28.55	49.04	20.49	551	502	5.43	1.3562	.3714	.4803	480	.018
DO-18	SI 9887	30.5654	2	28.55	49.04	20.49	620	583	3.71	1.3562	.3829	.3292	329	.012
DO-19	SI 9719	30.9457	1.5	345.55	371.5	25.95	660	601	4.86	1.2668	.3874	.2986	299	.011
DO-20	SI 9779	30.8421	1.5	345.55	371.5	25.95	688	629	4.80	1.2668	.3917	.2957	296	.011
DO-21	SI 9796	30.4504	1.5	345.55	371.5	25.95	673	602	6.04	1.2668	.3885	.3768	377	.014
DO-22	SI 9896	30.8863	1.5	345.55	371.5	25.95	683	607	6.51	1.2668	.3896	.4006	401	.015
DO-23	SI 9755	30.6307	1.5	345.55	371.5	25.95	680	604	6.52	1.2668	.3892	.4045	404	.015
DO-24	SI 9710	30.1749	1.5	345.55	371.5	25.95	678	611	5.62	1.2668	.3896	.3541	354	.013
DO-25	SI 9758	30.6346	1.5	345.55	371.5	25.95	686	602	7.31	1.2668	.3895	.4532	453	.017
DO-26	SI 9771	30.5084	1.5	345.55	371.51	25.96	660	575	7.49	1.2667	.3854	.4665	466	.017
DO-27	SI 9816	30.0703	1.5	30.66	50.54	19.88	562	509	6.15	1.3697	.3728	.4199	420	.016
DO-28	SI 9708	30.4664	1.5	30.66	50.54	19.88	593	560	3.37	1.3697	.3791	.2275	227	.008
DO-29	SI 9700	30.5928	1.5	30.66	50.54	19.88	497	438	7.19	1.3697	.3623	.4826	483	.018
DO-30	SI 9791	30.4008	1.5	30.66	50.54	19.88	567	510	6.68	1.3697	.3732	.4512	451	.017
DO-31	SI 9845	30.3306	1.5	30.66	50.54	19.88	590	545	4.99	1.3697	.3777	.3378	338	.013
DO-32	SI 9826	30.4474	1.5	30.66	50.54	19.88	587	540	5.26	1.3697	.3771	.3552	355	.013
DO-33	SI 9721	30.3469	1.5	30.66	50.54	19.88	577	544	3.40	1.3697	.3766	.2303	230	.009
DO-34	SI 9835	30.5852	1.5	30.67	50.54	19.87	578	532	5.16	1.3699	.3758	.3464	346	.013
DO-35	SI 9770	30.7583	1.5	30.66	50.54	19.88	570	524	5.17	1.3697	.3745	.3455	345	.013
DO-36	SI 9696	30.2941	1.5	30.66	50.54	19.88	616	575	4.39	1.3697	.3820	.2979	298	.011
DO-37	SI 9756	30.3033	1.5	30.66	50.54	19.88	588	545	4.72	1.3697	.3775	.3202	320	.012
DO-38	SI 9910	30.4975	1.5	30.67	50.54	19.87	592	545	5.25	1.3699	.3778	.3540	354	.013

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **DOVER FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
DO-12AD	SI 9886	30.5883	1.5	30.7	48.54	17.84	627	582	5.57	1.4225	.3834	.3888	389	.014
DO-13AD	SI 9880	30.0119	1.5	30.7	48.54	17.84	626	577	6.17	1.4225	.3829	.4385	438	.016
DO-14AD	SJ 2680	30.2175	1.5	30.71	48.54	17.83	583	540	5.40	1.4228	.3768	.3810	381	.014
DO-15AD	SJ 2607	30.9935	1.5	30.71	48.54	17.83	631	581	6.30	1.4228	.3836	.4341	434	.016
DO-16AD	SJ 2688	30.6301	1.5	30.71	48.54	17.83	570	523	6.03	1.4228	.3745	.4204	420	.016
DO-17AD	SJ 2566	30.8623	1.5	30.71	48.54	17.83	601	539	8.19	1.4228	.3781	.5665	566	.021
DO-18AD	SJ 2551	30.5553	1.5	30.71	48.54	17.83	463	418	6.04	1.4228	.3581	.4220	422	.016
DO-12ADL	SI 9792	30.459	1.5	30.71	50.54	19.83	491	433	7.09	1.3708	.3614	.4784	478	.018
DO-13ADL	SI 9740	30.6719	1.5	30.71	50.54	19.83	490	433	6.95	1.3708	.3614	.4658	466	.017
DO-14ADL	SI 9784	28.3089	1.5	30.71	50.54	19.83	552	509	4.82	1.3708	.3720	.3504	350	.013
DO-15ADL	SI 9694	28.3328	1.5	30.71	50.54	19.83	563	512	5.89	1.3708	.3731	.4273	427	.016
DO-16ADL	SI 9823	29.8062	1.5	30.71	50.54	19.83	533	470	7.64	1.3708	.3675	.5270	527	.019
DO-17ADL	SI 9898	29.3457	1.5	30.71	50.54	19.83	534	472	7.50	1.3708	.3678	.5252	525	.019
DO-18ADL	SI 9900	30.1059	1.5	30.71	50.54	19.83	569	513	6.55	1.3708	.3736	.4476	448	.017
DO-12BL	SJ 2548	28.9878	1.5	28.73	50.54	21.81	590	535	5.68	1.3299	.3769	.3912	391	.014
DO-13BL	SI 9685	30.0294	1.5	28.73	50.54	21.81	579	526	5.47	1.3299	.3754	.3632	363	.013
DO-14BL	SI 9867	24.3633	1.5	28.73	50.54	21.81	592	553	3.72	1.3299	.3785	.3045	305	.011
DO-15BL	SI 9893	29.4351	1.5	28.73	50.54	21.81	546	498	4.93	1.3299	.3707	.3342	334	.012
DO-16BL	SI 9725	29.1405	1.5	28.73	50.54	21.81	504	446	6.31	1.3299	.3635	.4320	432	.016
DO-17BL	SI 9761	30.4558	1.5	28.73	50.54	21.81	551	491	6.42	1.3299	.3705	.4204	420	.016
DO-18BL	SI 9909	30.3767	1.5	28.73	50.54	21.81	605	551	5.52	1.3299	.3793	.3626	363	.013

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **NEW DOVER FIELD**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
DN-1	SJ 2667	29.1377	1.5	319.74	342.46	22.72	753	703	4.46	1.3138	.4024	.3019	302	.011
DN-2	SJ 2617	29.4042	1.5	319.74	342.46	22.72	762	714	4.22	1.3138	.4040	.2831	283	.010
DN-3	SJ 2548	30.7236	1.5	319.74	342.46	22.72	749	692	5.25	1.3138	.4013	.3365	337	.012
DN-4	SJ 2628	28.2641	1.5	319.74	342.46	22.72	762	705	5.22	1.3138	.4033	.3637	364	.013
DN-5	SJ 2558	29.2499	1.5	319.74	342.46	22.72	755	707	4.24	1.3138	.4029	.2856	286	.011
DN-6	SJ 2647	29.5304	1.5	319.74	342.46	22.72	752	708	3.80	1.3138	.4027	.2538	254	.009
DN-7	SJ 2725	30.3701	1.5	319.74	342.46	22.72	746	689	5.25	1.3138	.4008	.3409	341	.013
DN-8	SJ 2547	29.0874	1.5	319.74	342.46	22.72	751	698	4.80	1.3138	.4019	.3251	325	.012
DN-9	SJ 2521	30.1773	1.5	319.74	342.47	22.73	747	692	5.03	1.3136	.4011	.3282	328	.012
DN-10	SJ 2730	30.6907	1.5	319.74	342.47	22.73	746	696	4.48	1.3136	.4013	.2873	287	.011
DN-11	SJ 2735	30.2747	1.5	319.75	342.47	22.72	750	702	4.25	1.3138	.4021	.2765	277	.010
DN-12	SI 9876	30.0231	1.5	319.75	342.47	22.72	746	696	4.48	1.3138	.4013	.2939	294	.011
DN-13	SJ 2642	30.0729	1.5	319.75	342.47	22.72	745	694	4.59	1.3138	.4011	.3008	301	.011
DN-14	SI 9799	29.7951	1.5	319.75	342.47	22.72	753	706	4.13	1.3138	.4026	.2733	273	.010
DN-15	SI 9781	29.5701	1.5	319.75	342.47	22.72	738	689	4.38	1.3138	.4002	.2921	292	.011
DN-16	SI 9824	29.0993	1.5	319.75	342.47	22.72	761	721	3.35	1.3138	.4044	.2267	227	.008
DN-17	SI 9802	30.4551	1.5	319.75	342.47	22.72	741	697	3.82	1.3138	.4010	.2474	247	.009
DN-18	SI 9910	30.6062	1.5	319.75	342.47	22.72	738	684	4.94	1.3138	.3998	.3180	318	.012

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **FLORENCE-OAKDALE**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
F-00	SI 9826	30.55	2.00	320.49	339.65	19.16	745.00	635.00	13.47	1.3869	.3966	1.2231	1223	.045
F-50	SI 9670	30.16	2.00	320.49	339.65	19.16	746.00	696.00	5.50	1.3869	.4013	.5054	505	.019
F-100	SI 9682	30.30	2.00	320.49	339.64	19.15	742.00	680.00	7.09	1.3871	.3998	.6494	649	.024
F-150	SI 9683	30.54	2.00	320.49	339.64	19.15	738.00	649.00	10.70	1.3871	.3971	.9720	972	.036
F-200	SI 9764	30.65	2.00	320.49	339.64	19.15	761.00	663.00	11.79	1.3871	.3999	1.0670	1067	.039
F-250	SI 9667	30.65	2.00	320.49	339.64	19.15	740.00	620.00	14.86	1.3871	.3950	1.3447	1345	.050
F-300	SI 9689	30.47	2.00	320.49	339.64	19.15	736.00	664.00	8.44	1.3871	.3981	.7682	768	.028
F-350	SI 9842	30.78	2.00	320.49	339.64	19.15	737.00	620.00	14.47	1.3871	.3948	1.3042	1304	.048
F-400	SI 9770	30.30	2.00	320.49	339.64	19.15	753.00	654.00	11.96	1.3871	.3986	1.0953	1095	.041
F-450	SI 9874	30.93	2.00	320.49	339.64	19.15	749.00	714.00	3.53	1.3871	.4030	.3166	317	.012
F-500	SI 9684	30.24	2.00	320.49	339.64	19.15	723.00	694.00	2.79	1.3871	.3994	.2556	256	.009
F-550	SI 9819	30.62	2.00	320.49	339.64	19.15	747.00	703.00	4.71	1.3871	.4020	.4268	427	.016
F-600	SI 9731	30.49	2.00	320.49	339.64	19.15	760.00	734.00	2.34	1.3871	.4053	.2132	213	.008
F-650	SJ 2529	30.74	2.00	320.49	339.64	19.15	751.00	697.00	6.01	1.3871	.4018	.5426	543	.020
F-700	SI 9726	30.74	2.00	320.76	339.64	18.88	761.00	719.00	4.50	1.3940	.4043	.4079	408	.015
F-750	SI 9716	30.60	2.00	325.89	339.63	13.74	756.00	703.00	8.57	1.5827	.4026	.8869	887	.033
F-800	SJ 2680	30.35	2.00	319.86	339.68	19.82	753.00	653.00	11.66	1.3712	.3986	1.0533	1053	.039
F-850	SJ 2609	30.60	2.00	319.86	339.68	19.82	748.00	691.00	6.17	1.3712	.4011	.5526	553	.020
F-900	SJ 2688	30.40	2.00	319.86	339.68	19.82	743.00	634.00	12.87	1.3711	.3963	1.1611	1161	.043
F-950	SJ 2566	30.20	2.00	319.86	339.68	19.82	760.00	662.00	11.36	1.3711	.3998	1.0317	1032	.038
F-1000	SJ 2671	30.22	2.00	319.86	339.68	19.82	748.00	675.00	8.21	1.3711	.3999	.7445	745	.028
F-1050	SJ 2769	30.31	2.00	319.86	339.68	19.82	749.00	665.00	9.61	1.3711	.3992	.8694	869	.032
F-1100	SJ 2619	30.40	2.00	319.86	339.68	19.82	728.00	651.00	8.79	1.3711	.3965	.7932	793	.029
F-1150	SJ 2782	30.65	2.00	319.86	339.68	19.82	749.00	632.00	13.88	1.3711	.3966	1.2415	1241	.046
F-1200	SJ 2543	30.88	2.00	319.86	339.68	19.82	765.00	654.00	13.01	1.3711	.3996	1.1552	1155	.043

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **OIL CITY [Enniskillen 1-16-1V Pool]**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Bq/g
OC-1	SI 9866	25.8393	2	317.53	340.75	23.22	744	677	6.21	1.3055	.3997	.6278	628	.023
OC-2	SI 9787	27.3563	2	317.53	340.75	23.22	758	680	7.37	1.3055	.4010	.7035	704	.026
OC-3	SI 9798	28.0454	2	317.53	340.75	23.22	744	663	7.75	1.3055	.3986	.7211	721	.027
OC-4	SI 9858	22.1416	2	317.53	340.75	23.22	735	673	5.69	1.3055	.3987	.6711	671	.025
OC-5	SI 9773	25.2703	2	317.53	340.75	23.22	752	679	6.84	1.3055	.4005	.7072	707	.026
OC-6	SI 9769	24.0106	2	317.53	340.75	23.22	733	651	7.89	1.3055	.3969	.8583	858	.032
OC-7	SI 9701	24.1724	2	317.54	340.75	23.21	741	676	6.01	1.3057	.3994	.6488	649	.024
OC-8	SI 9807	24.8336	2	317.54	340.75	23.21	758	671	8.36	1.3057	.4003	.8788	879	.033
OC-9	SI 9730	27.9379	2	317.54	340.76	23.22	743	658	8.19	1.3055	.3982	.7652	765	.028
OC-10	SI 9894	26.1772	2	317.54	340.76	23.22	743	674	6.43	1.3055	.3994	.6418	642	.024
OC-11	SI 9661	23.2866	2	317.54	340.76	23.22	725	675	4.40	1.3055	.3981	.4937	494	.018
OC-12	SI 9810	27.4425	2	317.54	340.76	23.22	738	659	7.55	1.3055	.3979	.7179	718	.027
OC-13	SI 9662	30.4403	2	317.54	340.76	23.22	736	652	8.10	1.3055	.3972	.6950	695	.026
OC-14	SI 9725	27.3712	2	317.54	340.76	23.22	745	677	6.32	1.3055	.3998	.6028	603	.022
OC-15	SI 9820	22.7043	2	317.54	340.76	23.22	742	681	5.56	1.3055	.3999	.6399	640	.024
OC-16	no sample													
OC-17	SI 9761	27.7653	2	317.54	340.76	23.22	752	684	6.30	1.3055	.4009	.5924	592	.022
OC-18	SI 9783	29.1838	2	317.54	340.76	23.22	726	686	3.31	1.3055	.3990	.2963	296	.011
OC-19	SI 9865	28.5039	2	317.54	340.76	23.22	760	710	4.33	1.3055	.4035	.3967	397	.015
OC-20	SI 9776	28.7028	2	317.54	340.76	23.22	765	705	5.40	1.3055	.4035	.4911	491	.018
OC-20B	SI 9870	25.1642	2	317.55	331.44	13.89	757	728	4.15	1.5750	.4046	.5200	520	.019
OC-21	SI 9790	26.0046	2	317.55	340.76	23.21	751	694	5.11	1.3057	.4016	.5131	513	.019
OC-22	SI 9720	30.4198	2	317.55	340.76	23.21	746	688	5.23	1.3057	.4007	.4490	449	.017
OC-23	SI 9839	30.7749	2	317.55	340.76	23.21	758	704	4.77	1.3057	.4029	.4047	405	.015
OC-24	SI 9897	28.482	2	317.55	340.76	23.21	746	680	6.10	1.3057	.4001	.5594	559	.021
OC-25	SI 9881	30.568	2	317.55	340.76	23.21	741	700	3.40	1.3057	.4013	.2902	290	.011
OC-26	SI 9821	27.4378	2	317.55	340.77	23.22	752	673	7.50	1.3055	.4000	.7137	714	.026
OC-27	SI 9904	27.2936	2	317.55	340.77	23.22	761	694	6.17	1.3055	.4023	.5899	590	.022
OC-28	SJ 2551	30.1659	2	319.83	340.77	20.94	754	684	7.33	1.3468	.4010	.6545	655	.024
OC-29	SI 9684	30.6229	2	29.59	49.43	19.84	647	564	9.90	1.3706	.3835	.8863	886	.033
OC-30	SI 9874	30.9079	2	29.59	49.43	19.84	620	538	9.89	1.3060	.6795	.8767	877	.032
OC-31	SJ 2748	29.7814	2	319.83	340.77	20.94	743	682	6.28	1.3468	.4000	.5677	568	.021
OC-20C	SI 9870	25.1642	2	331.44	340.76	9.32	728	710	3.81	1.9327	.4010	.5853	585	.022

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **OIL SPRINGS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Bq/g
OS-1	SJ 2767	30.4913	2	344.48	372.48	28	672	580	7.49	1.2434	.3867	.6110	611	.023
OS-2	SJ 2753	30.4081	2	344.48	372.48	28	680	582	8.03	1.2434	.3875	.6565	656	.024
OS-3	SJ 2614	30.5382	2	344.48	372.48	28	697	595	8.34	1.2434	.3898	.6792	679	.025
OS-4	SJ 2543	30.5494	2	344.48	372.48	28	652	547	8.80	1.2434	.3826	.7160	716	.026
OS-5	SJ 2529	30.4913	2	344.48	372.48	28	701	606	7.67	1.2434	.3909	.6258	626	.023
OS-6	SI 9726	30.5819	2	344.49	372.48	27.99	719	622	7.80	1.2435	.3936	.6343	634	.023
OS-7	SI 9716	30.1982	2	344.49	372.48	27.99	700	608	7.40	1.2435	.3910	.6095	609	.023
OS-8	SI 9856	30.3669	2	344.49	372.48	27.99	667	575	7.51	1.2435	.3859	.6152	615	.023
OS-9	SI 9831	91.3868	1.5	57.74	78.66	20.92	522	322	25.90	1.3472	.3553	.5728	573	.021
OS-10	SI 9793	90.9527	1.5	57.74	78.66	20.92	559	296	34.29	1.3474	.3561	.7620	762	.028
OS-11	SI 9802	91.5221	1.5	57.74	78.66	20.91	581	314	34.54	1.3474	.3592	.7628	763	.028
OS-12	SI 9794	91.2761	1.5	57.74	78.66	20.91	436	173	36.30	1.3474	.3372	.8037	804	.030
OS-13	SJ 2759	91.6339	1.5	57.74	78.66	20.91	540	346	24.87	1.3474	.3585	.5486	549	.020
OS-14	SI 9842	91.3471	1.5	57.74	78.66	20.90	507	286	29.09	1.3476	.3514	.6437	644	.024
OS-15	SI 9764	91.6917	1.5	57.74	78.66	20.90	510	176	45.57	1.3476	.3431	1.0046	1005	.037
OS-16	SI 9703	29.7558	2	344.49	372.48	27.99	672	610	4.69	1.2435	.3890	.3919	392	.014
OS-17	SI 9718	30.8331	2	344.52	372.48	27.96	632	539	7.74	1.2438	.3805	.6242	624	.023
OS-18	SI 9775	30.8739	2	344.52	372.48	27.96	645	544	8.45	1.2438	.3819	.6812	681	.025
OS-19	SI 9655	30.4156	2	344.52	372.48	27.96	625	518	9.11	1.2438	.3783	.7451	745	.028
OS-20	SI 9899	30.8974	2	344.52	372.48	27.96	658	564	7.74	1.2438	.3844	.6232	623	.023
OS-21	SI 9847	30.3991	2	344.52	372.48	27.96	651	564	7.10	1.2438	.3839	.5811	581	.021
OS-22	SI 9806	30.6061	2	344.52	372.48	27.96	646	516	11.24	1.2438	.3798	.9134	913	.034
OS-23	SI 9722	30.2269	2	344.52	372.48	27.96	619	523	8.07	1.2438	.3782	.6643	664	.025
OS-24	SI 9763	30.5259	1.5	29.59	49.42	19.83	574	497	9.41	1.3708	.3728	.6339	634	.023
OS-25	SI 9657	30.3861	1.5	29.59	49.42	19.83	567	422	18.95	1.3708	.3665	1.2822	1282	.047
OS-26	SI 9687	30.3284	1.5	29.59	49.42	19.83	585	479	13.36	1.3708	.3722	.9055	905	.034
OS-27	SI 9695	30.4769	1.5	29.59	49.42	19.83	595	515	9.73	1.3708	.3758	.6565	657	.024
OS-28	SI 9731	30.5691	1.5	29.59	49.42	19.83	654	565	10.68	1.3708	.3842	.7182	718	.027
OS-29	SI 9819	30.8102	1.5	29.59	49.42	19.83	628	544	10.13	1.3708	.3805	.6758	676	.025
OS-30	SI 9713	30.8826	1.5	29.59	49.42	19.83	607	526	9.81	1.3708	.3775	.6534	653	.024

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **TERMINUS NORTH**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
TN-1	SJ 2764	30.7074	2	319.82	339.69	19.87	755	694	6.63	1.3699	.4019	.5919	592	.022
TN-2	SJ 2687	30.3609	2	319.82	339.69	19.87	756	695	6.63	1.3699	.4020	.5984	598	.022
TN-3	SJ 2759	29.6881	2	319.82	339.69	19.87	742	682	6.54	1.3699	.3999	.6040	604	.022
TN-4	SJ 2614	29.2337	2	319.82	339.69	19.87	753	697	6.01	1.3699	.4020	.5629	563	.021
TN-5	SJ 2722	30.5661	2	319.82	339.69	19.87	762	698	6.99	1.3699	.4027	.6268	627	.023
TN-6	SJ 2694	30.9062	2	319.82	339.69	19.87	752	699	5.63	1.3699	.4020	.4990	499	.018
TN-7	SJ 2702	30.8631	2	319.82	339.69	19.87	764	704	6.48	1.3699	.4033	.5753	575	.021
TN-8	SJ 2707	30.0084	2	319.83	339.69	19.86	741	676	7.19	1.3701	.3994	.6565	656	.024
TN-9	SJ 2700	30.2669	2	319.83	339.69	19.86	753	692	6.64	1.3701	.4016	.6015	601	.022
TN-10	SJ 2753	30.7572	2	319.83	339.69	19.86	738	683	5.92	1.3701	.3997	.5277	528	.020
TN-11	SJ 2679	30.0314	2	319.83	339.69	19.86	748	683	7.17	1.3701	.4005	.6539	654	.024
TN-12	SJ 2767	30.1297	2	319.83	339.69	19.86	742	673	7.70	1.3701	.3993	.7000	700	.026
TN-13	SJ 2552	30.2094	2	319.83	339.7	19.87	766	703	6.85	1.3699	.4034	.6216	622	.023
TH-14	SJ 2692	30.3517	2	319.83	339.7	19.87	762	707	5.86	1.3699	.4034	.5286	529	.020
TN-15	SJ 2520	30.5233	2	319.83	339.7	19.87	742	680	6.80	1.3699	.3998	.6103	610	.023
TN-16	SJ 2672	30.3166	2	319.83	339.7	19.87	746	689	6.15	1.3699	.4008	.5560	556	.021

Radon Emanation Potential
(Apparent Radium)
Uranium and Radium Assays

RADON-HYDROCARBON STUDY SAMPLES TAKEN FOR RADIUM AND URANIUM ANALYSES
Samples 1-62 incl. Radium and Uranium: Samples 63-157 incl. Uranium only

1	CA3-6	42	OS-GB-150	83	CH-1	124	F-900S
2	CA3-7	43	CO-22-S-0	84	CH-2	125	F-1000S
3	CA3-8	44	CO-22-S-50	85	CH-3	126	F-1100S
4	CA3-9	45	CO-22-S-100	86	CH-4	127	F-1200S
5	CA3-10	46	CO-22-S-150	87	CH-5	128	DN-1
6	CA3-11	47	OC-16-0	88	CH-6	129	DN-2
7	CA3-12	48	OC-16-50	89	CH-7	130	DN-3
8	CA3-13	49	OC-16-100	90	CH-8	131	DN-6
9	CA3-14	50	OC-16-150	91	CH-9	132	DN-8
10	CA3-15	51	DG-5-S-0	92	CH-19	133	DN-10
11	CO-12	52	DG-5-S-20	93	DO-1	134	DN-12
12	CO-13	53	DG-5-S-40	94	DO-3	135	DN-14
13	CO-14	54	DG-5-S-60	95	DO-5	136	DN-16
14	CO-15	55	DG-5-S-80	96	DO-7	137	DN-18
15	CO-16	56	DG-5-S-100	97	DO-9	138	TN-1
16	CO-17	57	CH-4-S-0	98	DO-11	139	TN-2
17	CO-18	58	CH-4-S-20	99	DO-19	140	TN-3
18	CO-19	59	CH-4-S-40	100	DO-22	141	TN-5
19	DG-10	60	CH-4-S-60	101	DO-25	142	TN-7
20	DG-11	61	CH-4-S-80	102	DO-26	143	TN-9
21	DG-12	62	CH-4-S-100	103	DG-5W-0	144	TN-11
22	DG-13	63	CA1-1	104	DG-5W-20	145	TN-13
23	DG-14	64	CA1-3	105	DG-5W-40	146	TN-15
24	DG-15	65	CA1-5	106	DG-5W-60	147	TN-16
25	DG-16	66	CA1-7	107	DG-5W-80	148	OC-2
26	DG-17	67	CA1-9	108	DG-5W-100	149	OC-4
27	DG-5-N-0	68	CA1-11	109	DG-5E-0	150	OC-6
28	DG-5-N-20	69	CA1-13	110	DG-5E-20	151	OC-8
29	DG-5-N-40	70	CA1-15	111	DG-5E-40	152	OC-10
30	DG-5-N-60	71	CA1-17	112	DG-5E-60	153	OC-12
31	DG-5-N-80	72	CA1-19	113	DG-5E-80	154	OC-14
32	DG-5-N-100	73	OS-1	114	DG-5E-100	155	OC-18
33	CH-4-N-0	74	OS-3	115	F-0S	156	OC-22
34	CH-4-N-20	75	OS-5	116	F-100S	157	OC-26
35	CH-4-N-40	76	OS-7	117	F-200S		
36	CH-4-N-60	77	OS-8	118	F-300S		
37	CH-4-N-80	78	OS-16	118	F-400S		
38	CH-4-N-100	79	OS-17	120	F-500S		
39	OS-GB-50	80	OS-19	121	F-600S		
40	OS-GB-70	81	OS-20	122	F-700S		
41	OS-GB-100	82	OS-21	123	F-800S		

Results of Radium Analysis

Prefix	Number	Bi-214 (pCi/g)	Est.Ra-226 (pCi/g)
CA3-	6	1.93	2.02
	7	1.61	1.68
	8	1.19	1.24
	9	2.08	2.17
	10	1.58	1.65
	11	1.38	1.44
	12	1.75	1.82
	13	1.82	1.90
	14	1.76	1.83
	15	1.38	1.44
CO-	12	2.51	2.64
	13	1.60	1.68
	14	3.95	4.16
	15	1.66	1.75
	16	1.49	1.57
	17	2.11	2.22
	18	1.96	2.07
	19	1.67	1.74
DG-	10	3.05	3.24
	11	3.77	4.00
	12	3.52	3.74
	13	2.47	2.62
	14	2.42	2.57
	15	3.55	3.76
	16	2.48	2.62
	17	3.86	4.06
DG-5-N-0		2.83	3.13
	20	3.12	3.45
	40	3.62	3.85
	60	2.66	2.83
	80	3.58	3.80
	100	3.16	3.36
CH-4-N-0		0.83	0.94
	20	1.26	1.42
	40	1.34	1.50
	60	1.05	1.16
	80	1.01	1.12
	100	1.98	2.19
OS-GB-	50	3.35	3.78
	70	2.07	2.34
	100	2.01	2.26
	150	2.20	2.47
CO-22-S-0		1.44	1.64
	50	2.00	2.27
	100	2.39	2.69
	150	2.04	2.27
OC-16-	0	1.84	2.12
	50	3.49	3.95
	100	3.74	4.24
	150	2.70	3.06
DG-5-S-0		2.98	3.45
	20	2.80	3.24
	40	3.35	3.87
	60	3.68	4.25
	80	3.62	4.18
	100	3.55	4.10
CH-4-S-	0	1.20	1.38
	20	1.22	1.40
	40	1.15	1.32
	60	1.88	2.16
	80	1.51	1.74
	100	1.55	1.76

The Ra-226 estimate is based on Bi-214, assuming equilibrium between Rn-222 and Bi-214, and assuming an experimentally determined initial Ra-226:Rn-222 ratio of (1.23 +/- 0.26)

Results of Uranium Analysis

Sample description	U PPM
1	3.5
2	3.8
3	3.0
4	3.7
5	3.2
6	4.0
7	3.8
8	4.0
9	4.2
10	4.4
11	4.8
12	3.7
13	7.2
14	4.5
15	3.8
16	2.9
17	3.8
18	3.4
19	9.8
20	9.0
21	5.4
22	5.2
23	5.1
24	8.2
25	6.5
26	6.9
27	8.5
28	9.2
29	9.6
30	9.4
31	9.5
32	1.9
33	1.8
34	2.1
35	1.8
36	1.8
37	1.8
38	2.0
39	3.4
40	4.0
41	3.1
42	2.7
43	3.8
44	4.3
45	4.5
46	3.7
47	6.7
48	5.2
49	5.0
50	4.8
51	9.7
52	11.0
53	9.4
54	10.1
55	8.9
56	8.2
57	1.7
58	2.0
59	1.9
60	1.8
61	3.0
62	2.0
63	5.5
64	9.0
65	6.0
66	7.3
67	8.4
68	8.0
69	10.0
70	8.1
71	5.2
72	6.1
73	5.3
74	6.9
75	5.4
76	5.4
77	5.0
78	2.5
79	6.8
80	6.0
81	7.7
82	6.3
83	2.8
84	2.5
85	2.7
86	2.7
87	2.1
88	3.5
89	2.0
90	3.0
91	3.1
92	2.3
93	3.9
94	3.6
95	1.9
96	1.8
97	2.0
98	3.1
99	3.6
100	5.5
101	5.1
102	4.7
103	8.6
104	12.1
105	11.9
106	11.2
107	12.1
108	10.6
109	10.6
110	10.7
111	10.9
112	12.5
113	11.5
114	19.4
115	13.1
116	6.0
117	12.1
118	9.2
119	10.9
120	4.9
121	3.6
122	4.9
123	7.2
124	10.7
125	6.6
126	7.5
127	9.4
128	4.3
129	3.7
130	4.3
131	3.3
132	3.7
133	3.8
134	3.9
135	3.7
136	4.0
137	2.9
138	6.0
139	8.7
140	6.0
141	6.2
142	6.7
143	5.8
144	7.5
145	5.9
146	5.3
147	5.5
148	6.6
149	5.7
150	7.5
151	6.6
152	6.5
153	7.0
154	8.4
155	3.0
156	4.5
157	6.0

APPENDIX IV

Radon Emanation Potential Data for Soil Profiles

AURORA ENVIRONMENTAL SURVEYS LIMITED

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **PROFILES VARIOUS AREAS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
DG-4N-0	SJ 2558	30.4169	2	20.95	42.47	21.52	584	469	13.38	1.3353	.3714	1.1751	1175	.043
20	SI 9817	30.8864	2	20.95	42.47	21.52	534	411	14.74	1.3353	.3631	1.2743	1274	.047
40	SI 9751	30.5561	2	20.95	42.47	21.52	554	439	13.56	1.3353	.3668	1.1856	1186	.044
60	SI 9837	30.5051	2	20.95	42.47	21.52	553	424	15.39	1.3353	.3655	1.3477	1348	.050
80	SJ 2730	30.7293	2	20.95	42.47	21.52	574	438	16.16	1.3353	.3682	1.4042	1404	.052
100A	SJ 2735	30.1796	2	20.95	42.47	21.52	590	463	14.89	1.3353	.3714	1.3172	1317	.049
100B	SI 9876	23.6524	2	20.95	42.47	21.52	594	461	15.63	1.3353	.3715	1.7647	1765	.065
DG-4S-0	SI 9667	30.1011	2	20.95	42.47	21.52	541	443	11.43	1.3353	.3661	1.0145	1015	.038
20	SI 9848	30.9699	2	20.95	42.47	21.52	524	419	12.44	1.3353	.3629	1.0727	1073	.040
40	SJ 2547	30.3661	2	20.95	42.47	21.52	560	436	14.70	1.3353	.3670	1.2924	1292	.048
60	SI 9727	30.8374	2	20.95	42.47	21.52	603	490	13.02	1.3353	.3745	1.1273	1127	.042
80	SJ 2647	30.8164	2	20.95	42.47	21.52	589	444	17.21	1.3353	.3698	1.4917	1492	.055
100	SJ 2725	30.4989	2	20.95	42.48	21.53	548	418	15.55	1.3351	.3647	1.3616	1362	.050
DG-4E-0	SI 9772	29.8313	2	20.75	42.45	21.7	563	465	11.22	1.3319	.3695	1.0017	1002	.037
20	SI 9707	30.4945	2	20.75	42.45	21.7	624	523	11.29	1.3319	.3786	.9860	986	.036
40	SI 9825	30.1521	2	20.75	42.45	21.7	625	515	12.40	1.3319	.3781	1.0957	1096	.041
60	SI 9734	30.2522	2	20.75	42.45	21.7	635	516	13.47	1.3319	.3789	1.1858	1186	.044
80	SI 9743	30.7509	2	20.75	42.45	21.7	662	525	15.53	1.3319	.3817	1.3457	1346	.050
100	SI 9675	30.6011	2	20.75	42.45	21.7	607	443	19.36	1.3319	.3712	1.6851	1685	.062
DG-4W-0	SI 9663	28.0834	2	20.93	42.45	21.52	640	530	12.43	1.3353	.3804	1.1823	1182	.044
20	SI 9855	30.3086	2	20.93	42.46	21.53	627	519	12.25	1.3351	.3785	1.0789	1079	.040
40	SI 9678	30.7045	2	20.93	42.46	21.53	563	447	13.63	1.3351	.3681	1.1856	1186	.044
60	SI 9747	30.6978	2	20.93	42.46	21.53	511	348	20.23	1.3351	.3564	1.7601	1760	.065
80	SI 9849	30.8895	2	20.93	42.46	21.53	573	412	19.42	1.3351	.3661	1.6786	1679	.062
100	SJ 2628	30.7109	2	20.93	42.46	21.53	546	352	24.06	1.3351	.3594	2.0922	2092	.077
CONTROL	SI 9735	0	2	20.93	42.46	21.53	557	545	.48	1.3351	.3752			.000
DG-5N-0	SI 9876	30.2623	2	348.71	371.58	22.87	695	593	10.45	1.3112	.3895	.9052	905	.033
20	SJ 2735	30.1083	2	348.71	371.58	22.87	706	589	12.11	1.3112	.3900	1.0549	1055	.039
40	SJ 2730	30.3327	2	348.71	371.58	22.87	697	574	12.85	1.3112	.3882	1.1110	1111	.041
60	SJ 2521	30.5514	2	348.71	371.58	22.87	696	542	16.46	1.3112	.3856	1.4126	1413	.052
80	SJ 2547	30.5614	2	348.71	371.58	22.87	699	560	14.69	1.3112	.3872	1.2605	1261	.047
100	SJ 2725	30.4679	2	348.71	371.58	22.87	689	548	14.99	1.3112	.3855	1.2898	1290	.048
DG-5S-0	SJ 2647	30.2091	2	348.71	371.58	22.87	704	590	11.78	1.3112	.3899	1.0224	1022	.038
20	SI 9727	30.4051	2	349.48	372.42	22.94	715	603	11.46	1.3101	.3918	.9872	987	.037
40	SI 9848	30.4315	2	349.48	372.43	22.95	648	527	12.84	1.3099	.3808	1.1054	1105	.041
60	SI 9669	30.3229	2	349.48	372.43	22.95	681	542	14.75	1.3099	.3845	1.2742	1274	.047
80	SI 9837	30.6341	2	349.48	372.43	22.95	682	553	13.58	1.3099	.3854	1.1613	1161	.043
100	SI 9751	30.3296	2	349.48	372.43	22.95	694	556	14.55	1.3099	.3866	1.2568	1257	.047

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **PROFILES VARIOUS AREAS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
DG-5E-0	SI 9817	30.6942	2	349.48	372.43	22.95	651	533	12.47	1.3099	.3815	1.0646	1065	.039
20	SJ 2558	30.1497	2	349.48	372.43	22.95	706	584	12.64	1.3099	.3896	1.0982	1098	.041
40	SI 9735	30.7491	2	349.48	372.43	22.95	675	556	12.46	1.3099	.3851	1.0615	1062	.039
60	SJ 2628	30.5759	2	349.48	372.43	22.95	704	547	16.69	1.3099	.3866	1.4299	1430	.053
80	SI 9849	30.8896	2	349.48	372.43	22.95	730	576	16.16	1.3099	.3909	1.3708	1371	.051
100	SI 9747	30.1521	2	349.48	372.43	22.95	658	510	15.95	1.3099	.3802	1.3862	1386	.051
DG-5W-0	SI 9678	28.2189	2	349.48	372.43	22.95	669	564	10.87	1.3099	.3852	1.0092	1009	.037
20	SI 9855	30.4538	2	349.48	372.43	22.95	749	630	12.07	1.3099	.3965	1.0385	1039	.038
40	SI 9663	30.9582	2	349.49	372.44	22.95	762	642	12.12	1.3099	.3984	1.0255	1026	.038
60	SI 9675	30.4457	2	349.49	372.44	22.95	741	609	13.58	1.3099	.3943	1.1688	1169	.043
80	SI 9661	36.1676	2	62.45	78.61	16.16	435	333	17.06	1.4773	.3494	1.3935	1393	.052
100	SI 9701	41.6383	2	62.45	78.61	16.16	461	333	21.53	1.4773	.3514	1.5279	1528	.057
CH-4S-0	SJ 2722	30.7573	2	344.63	372.7	28.07	697	649	3.34	1.2427	.3939	.2695	269	.010
20	SJ 2759	30.5505	2	344.63	372.7	28.07	684	628	4.09	1.2427	.3913	.3329	333	.012
40	SJ 2764	30.3272	2	344.63	372.7	28.07	694	630	4.81	1.2427	.3922	.3939	394	.015
60	SI 9682	30.3343	2	344.63	372.7	28.07	679	622	4.19	1.2427	.3905	.3437	344	.013
80	SI 9689	30.7013	2	344.63	372.7	28.07	664	607	4.23	1.2427	.3882	.3421	342	.013
100	SJ 2694	30.3539	2	344.63	372.7	28.07	698	644	3.88	1.2427	.3936	.3178	318	.012
CH-4N-0	SI 9791	30.7201	2	344.62	372.45	27.83	619	567	3.89	1.2452	.3816	.3154	315	.012
20	SI 9700	30.7848	2	344.62	372.45	27.83	543	499	3.26	1.2452	.3705	.2638	264	.010
40	SI 9708	30.2596	2	344.62	372.45	27.83	639	593	3.29	1.2452	.3852	.2704	270	.010
60	SI 9816	30.4615	2	344.62	372.45	27.83	628	562	5.20	1.2452	.3819	.4254	425	.016
80	SI 9763	30.9257	2	344.62	372.45	27.83	627	574	3.97	1.2452	.3828	.3197	320	.012
100	SI 9887	30.4822	2	344.62	372.46	27.84	671	620	3.70	1.2451	.3897	.3019	302	.011
CH-4E-0	SI 9729	30.4554	2	344.63	372.46	27.83	643	595	3.47	1.2452	.3856	.2835	284	.010
20	SI 9752	30.5246	2	344.63	372.46	27.83	617	561	4.28	1.2452	.3810	.3488	349	.013
40	SJ 2552	30.5894	2	344.63	372.46	27.83	702	641	4.56	1.2452	.3937	.3714	371	.014
60	SJ 2679	30.2812	2	344.63	372.46	27.83	684	622	4.69	1.2452	.3909	.3861	386	.014
80	SJ 2700	30.0554	2	344.63	372.46	27.83	693	636	4.21	1.2452	.3926	.3489	349	.013
100	SJ 2707	30.1383	2	344.63	372.46	27.83	678	626	3.78	1.2452	.3907	.3121	312	.012
CH-4W-0	SJ 2702	30.5553	2	344.64	372.7	28.06	704	652	3.69	1.2428	.3947	.3001	300	.011
20	SJ 2687	30.9291	2	344.64	372.7	28.06	696	644	3.70	1.2428	.3935	.2977	298	.011
40	SJ 2782	30.6301	2	344.64	372.7	28.06	631	573	4.39	1.2428	.3830	.3563	356	.013
60	SJ 2619	30.6257	2	344.64	372.7	28.06	651	593	4.35	1.2428	.3861	.3529	353	.013
80	SJ 2769	30.8349	2	344.64	372.7	28.06	660	605	4.05	1.2428	.3877	.3265	326	.012
100	SJ 2671	30.3818	2	344.64	372.7	28.06	574	523	3.84	1.2428	.3748	.3145	314	.012

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **PROFILES VARIOUS AREAS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	pCi/kg	Bq/g
OS-GB-50	SI 9697	30.4222	2	344.49	372.48	27.99	688	608	6.32	1.2435	.3901	.5168	517	.019
70	SI 9844	30.0124	2	344.49	372.48	27.99	673	602	5.52	1.2435	.3885	.4578	458	.017
100	SI 9822	30.0902	2	344.49	372.48	27.99	696	627	5.28	1.2435	.3922	.4364	436	.016
150	SI 9882	30.5463	2	344.49	372.48	27.99	666	609	4.24	1.2435	.3885	.3449	345	.013
CO-22E-0	SI 9770	28.1313	1.5	347.64	372.5	24.86	657	570	8.09	1.2811	.3848	.5526	553	.020
50	SI 9874	30.5658	1.5	347.64	372.5	24.86	710	620	8.21	1.2811	.3927	.5164	516	.019
100	SI 9684	30.3323	1.5	347.64	372.5	24.86	692	648	3.49	1.2811	.3935	.2213	221	.008
150	SI 9819	30.9611	1.5	347.64	372.5	24.86	705	630	6.67	1.2811	.3931	.4139	414	.015
CO-22W-0	SI 9731	26.7195	1.5	349.65	372.5	22.85	734	657	7.47	1.3116	.3974	.5503	550	.020
50	SI 9695	30.7071	1.5	349.65	372.5	22.85	695	599	9.77	1.3116	.3899	.6259	626	.023
100	SI 9901	30.9501	1.5	349.65	372.5	22.85	678	572	11.00	1.3116	.3866	.6989	699	.026
150	SI 9793	30.2528	1.5	349.65	372.5	22.85	672	610	5.97	1.3116	.3890	.3882	388	.014
CH-5N-0	SI 9783	30.806	1.5	18.69	36.46	17.77	636	603	3.81	1.4245	.3857	.2642	264	.010
20	SI 9776	30.8576	1.5	18.69	36.46	17.77	652	613	4.66	1.4245	.3877	.3224	322	.012
40	SI 9870	30.4817	1.5	18.69	36.46	17.77	678	636	5.03	1.4245	.3915	.3527	353	.013
60	SI 9720	30.9404	1.5	18.69	36.46	17.77	655	615	4.79	1.4245	.3881	.3311	331	.012
80	SI 9881	30.8863	1.5	18.69	36.46	17.77	658	622	4.20	1.4245	.3889	.2909	291	.011
CH-5S-0	SI 9821	30.6733	1.5	18.69	36.46	17.77	627	592	4.12	1.4245	.3842	.2871	287	.011
20	SI 9904	30.245	1.5	18.7	36.46	17.76	645	610	4.09	1.4248	.3869	.2888	289	.011
40	SJ 2667	30.2259	2	18.7	41.68	22.98	652	609	3.82	1.3094	.3874	.3314	331	.012
60	SI 9859	30.8307	2	18.7	41.68	22.98	581	544	3.27	1.3094	.3769	.2774	277	.010
80	SI 9661	30.7668	2	18.7	41.7	23	611	569	3.79	1.3091	.3812	.3221	322	.012
CH-5E-0	SI 9685	30.3874	2	18.96	41.68	22.72	597	555	3.87	1.3138	.3790	.3348	335	.012
20	SI 9782	30.9701	2	18.96	41.68	22.72	503	458	4.43	1.3138	.3643	.3759	376	.014
40	SI 9860	30.6813	2	18.96	41.68	22.72	599	552	4.45	1.3138	.3789	.3814	381	.014
60	SI 9789	30.9595	2	18.96	41.68	22.72	600	556	4.10	1.3138	.3793	.3480	348	.013
80	SI 9804	30.7446	2	18.96	41.68	22.72	541	498	4.11	1.3138	.3703	.3509	351	.013
CH-5W-0	SJ 2672	30.3077	2	18.97	41.73	22.76	562	528	2.99	1.3131	.3742	.2588	259	.010
20A	SJ 2520	30.8537	2	18.97	41.73	22.76	569	525	4.16	1.3131	.3745	.3537	354	.013
20B	SJ 2617	25.9325	2	18.97	41.73	22.76	605	570	3.03	1.3131	.3808	.3071	307	.011
40	SI 9838	30.7504	2	18.98	41.73	22.75	618	576	3.82	1.3132	.3822	.3266	327	.012
60	SI 9895	30.4729	2	18.98	41.73	22.75	618	578	3.59	1.3132	.3824	.3096	310	.011
80	SI 9748	30.6654	2	18.98	41.73	22.75	609	568	3.73	1.3132	.3809	.3191	319	.012
CA3-31W-0						0			.00	.0000	.0000	.0000	0	.000
50	SI 9779	30.3361	1.5	18.54	41.71	23.17	630	534	9.90	1.3063	.3799	.6395	639	.024
100	SI 9719	30.7687	1.5	18.54	41.71	23.17	601	503	10.26	1.3063	.3753	.6537	654	.024

RADON-HYDROCARBON EXPLORATION STUDY 1992-93

RADON EMANATION POTENTIAL DETERMINATION (Apparent Radium)

Project Area: **PROFILES VARIOUS AREAS**

Sample	Electret	Soil Wt. gms	Flask vol. L	Date Start	Date End	Total Days	V1	V2	Rn Conc. pCi/L	Equilib. Const. K	Calib. Factor	Rn Emanation Potential pCi/gram	Rn Emanation Potential pCi/kg	Rn Emanation Potential Bq/g
CA3-31E-0						0			.00	.0000	.0000	.0000	0	.000
50	SI 9676	30.9251	1.5	18.69	41.71	23.02	553	454	10.69	1.3088	.3678	.6783	678	.025
100	SI 9786	30.6239	1.5	18.69	41.71	23.02	606	533	7.38	1.3088	.3780	.4733	473	.018
CA3-31N-0						0			.00	.0000	.0000	.0000	0	.000
50	SI 9710	30.5412	1.5	18.54	41.71	23.17	612	516	9.98	1.3063	.3772	.6403	640	.024
100	SI 9755	30.4778	1.5	18.54	41.71	23.17	605	515	9.31	1.3063	.3765	.5986	599	.022
CA3-31S-0						0			.00	.0000	.0000	.0000	0	.000
50	SI 9896	30.9028	1.5	18.54	41.71	23.17	607	512	9.89	1.3063	.3765	.6268	627	.023
100	SI 9796	30.1482	1.5	18.54	41.71	23.17	603	515	9.09	1.3063	.3764	.5905	590	.022
CA2-29N-0	SI 9795	30.8525	1.5	347.66	372.49	24.83	676	594	7.50	1.2815	.3881	.4675	468	.017
50	SI 9769	30.7751	1.5	18.52	41.72	23.2	525	426	10.73	1.3058	.3635	.6831	683	.025
100	SI 9701	30.6594	1.5	18.52	41.72	23.2	573	474	10.50	1.3058	.3709	.6707	671	.025
CA2-29S-0	SI 9890	30.5094	1.5	347.66	372.49	24.83	692	608	7.66	1.2815	.3904	.4826	483	.018
50	SI 9661	30.5262	1.5	18.52	41.72	23.2	551	458	9.89	1.3058	.3680	.6344	634	.023
100	SI 9854	30.9129	1.5	18.52	41.72	23.2	669	581	8.81	1.3058	.3866	.5580	558	.021
CA2-29E-0	SJ 2692	25.7969	1.5	347.66	372.49	24.83	706	616	8.24	1.2815	.3921	.6139	614	.023
50	SI 9894	30.5774	1.5	18.52	41.72	23.2	552	452	10.72	1.3058	.3676	.6867	687	.025
100	SI 9730	30.8267	1.5	18.52	41.72	23.2	510	416	10.20	1.3058	.3616	.6481	648	.024
CA2-29W-0	SI 9712	30.5861	1.5	347.66	372.49	24.83	677	590	8.03	1.2815	.3879	.5046	505	.019
50	SI 9771	30.6057	1.5	18.54	41.72	23.18	577	488	9.31	1.3062	.3723	.5958	596	.022
100	SI 9758	30.6763	1.5	18.54	41.72	23.18	604	509	9.89	1.3062	.3760	.6319	632	.023
CA1-1N-0	SI 9860	30.8137	2	347.68	371.48	23.8	666	599	6.26	1.2964	.3877	.5264	526	.019
50	SI 9868	30.9921	2	18.52	41.71	23.19	576	507	6.96	1.3060	.3737	.5863	586	.022
100	SI 9749	30.6183	2	18.52	41.71	23.19	560	486	7.60	1.3060	.3708	.6483	648	.024
CA1-1S-0	SI 9685	30.5181	1.5	347.68	371.48	23.8	672	595	7.34	1.2964	.3879	.4674	467	.017
50														
100														
CA1-1E-0	SI 9859	30.307	1.5	347.68	371.48	23.8	662	580	7.92	1.2964	.3859	.5083	508	.019
50	SI 9883	30.2928	2	18.52	41.71	23.19	558	494	6.43	1.3060	.3713	.5542	554	.021
100	SI 9787	30.9159	2	18.52	41.71	23.19	538	461	8.04	1.3060	.3672	.6790	679	.025
CA1-1W-0	SI 9798	30.6502	1.5	347.68	371.48	23.8	679	598	7.75	1.2964	.3886	.4918	492	.018
50	SI 9736	30.2146	2	18.52	41.71	23.19	584	491	9.74	1.3060	.3731	.8423	842	.031
100	SJ 2643	30.9246	2	18.52	71.71	53.19	681	592	3.30	1.1157	.3883	.2384	238	.009

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm@	0.155 0	square inches	1 square inch	**6.451 6**	cm@
1 m@	10.763 9	square feet	1 square foot	**0.092 903 04**	*m@
1 km@	0.386 10	square miles	1 square mile	2.589 988	km@
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm#	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm#
1 m#	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m#
1 m#	1.308 0	cubic yards	1 cubic yard	0.764 555	m#
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

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