RADIATION SURVEYS AT ELLIOT LAKE

The attached report, "Recent Radiation Surveys at Elliot Lake, Ontario," by Dr. R. S. Eaton of the Atomic Energy Control Board staff, is a synopsis of the events and preliminary work leading to the recent decision to undertake a systematic survey of this northern Ontario community beginning in November, 1976.

The information was compiled in order to respond to enquiries which followed the announcement that the AECB would open a temporary office in Elliot Lake to coordinate the survey work and act as an information centre.

To present as full a picture as possible, the paper includes measurements determined in the preliminary surveys, with explanations as to their significance. It should be noted, however, that the measurements were not conducted on a random sampling basis, and hence the preliminary findings, such as those for the 34 dwellings mentioned on the final page, are not necessarily indicative of the extent of the problem in the community as a whole.

The preliminary work clearly indicates that there are two possible contamination problems in Elliot Lake, with the active natural rock effect predominating, and making the situation in that community significantly different from other locations which have to contend only with radioactive waste.

Nevertheless, the limited information now available from the preliminary surveys indicates that there is need for further investigation.

Following analysis of the results of the investigation, it will be possible to determine the extent of remedial measures necessary to ensure compliance with AECB standards.

In the interests of privacy for individual homeowners, the AECB does not publicly disclose specific addresses where survey work is to be carried out or the result of such surveys.

Technical Information Division
Ottawa, Ontario
Telephone (613) 992-9206

P.O. Box 1046
Ottawa, Canada
K1P 5S9

C.P. 1046
Ottawa, Canada
K1P 5S9
Recent Radiation Surveys
at
Elliot Lake, Ontario
R.S. Eaton

October 1976
Introduction

During the past 18 months the Atomic Energy Control Board (AECB), in cooperation with other federal and provincial agencies, has become increasingly involved in the investigation of radioactive contamination of many sites throughout the country. Many locations were found where low level radiation exceeded the stringent AECB schedules for public exposure and remedial action was taken to decrease the levels as close as possible to normal background radiation levels and to insure continuing improvement in the management of radioactive wastes. The principal sources of radioactive wastes are from uranium mining, milling and refining and from metallurgical operations involving slightly radioactive minerals and concentrates.

In order to accelerate the countrywide investigations and remedial programs, the Federal Government, in February 1976, established a federal-provincial task force under the direction of AECB so that personnel and equipment could be quickly activated to assist in the work. In the task force program, agencies of the governments of Ontario and Saskatchewan have effectively cooperated with several federal agencies, particularly the Departments of National Health & Welfare, Energy, Mines & Resources, Environment, National Defence, the National Research Council and Atomic Energy of Canada Limited.

Problems were identified early in the investigations at Port Hope and Uranium City. Preliminary investigations at Elliot Lake indicated little evidence of any problem and detailed investigations were deferred until recently when evidence emerged that clearly indicated an exploratory survey was warranted.

The present report briefly summarizes the early investigations and provides the general results of the more recent exploratory survey, September 1975

While undertaking a survey of the tailing piles at a mine site, a limited number of measurements of gamma radiation were made by the AECB of some of the roads and at one parking lot in the town. These results are shown below:

- Parking lot at Elliot Lake Centre: 0.010 - 0.012 mR/hr
- Westview Park Road: 0.015 - 0.020 mR/hr
- Gravel road near hospital: 0.040 - 0.070 mR/hr

Since the natural gamma background across Canada is generally in the range of 0.005 - 0.015 mR/hr, with the exception of the road near the hospital, the levels were close to normal background. In addition, most of these levels are below the acceptable level of 0.057 mR/hr.
for enclosed structures and are below the acceptable level in the open of 0.10 mR/hr.

It has been the experience of the AECB that the presence of minor quantities of ore within a mining townsit is not an unusual situation. As a result, at that time it was felt that the referenced readings did not indicate that there was a general contamination problem.

**January 1976**

To follow up this very limited survey, radon daughter measurements were made by the staff of the EMR Elliot Lake Laboratory in six houses situated in the town. Five of these houses indicated radon daughter concentrations of 0.002 - 0.02 working levels or within a nominal background; the sixth house, on the basis of a single measurement had a concentration of 0.04 WL; a slightly elevated reading with respect to what was typical of natural background. This value was not sufficiently above background to be a strong indication that there was a radon daughter problem in the town.

Subsequent comparison of the addresses to their locations relative to a mineralized quartzite zone that cuts across the town indicated that the first five houses referenced above were off the zone, the sixth being on it. Acceptable levels for continuous occupancy should not exceed an integrated value of 0.012 WLs, a value which allows for the effects of ventilation and changes in the weather.

**March 1976**

All public and separate, elementary and high schools were surveyed and reported to AECB by the Ontario Ministry of Health. In this case radon concentrations were measured and ranged from 0.3 to 2.5 picocuries/litre (pCi/l) with one reading in a basement boiler room of 6 pCi/l. All of the readings were within or close to the normal range found in buildings (about 4 pCi/l) and were judged to be of no health hazard to staff and pupils. The one higher reading is not sufficiently above average to be significant.

**June - July 1976**

A further eleven houses in Elliot Lake were surveyed by one of the mining companies and the EMR Elliot Lake Laboratory. Of these houses, four were significantly above background (readings ranged from 0.045 - 0.124 WLs) but three of them had been closed up and unoccupied for a considerable period before the measurements were taken. As unventilated, unoccupied buildings accumulate radon, the high readings in these houses were again not necessarily significant. Ventilation was tried and this rapidly reduced the radon gas and daughter concentrations. The high reading in the occupied house (0.10 WL) was a cause for concern. It was reported to the AECB that waste rock might be present near those buildings which produced high readings.
The other seven houses had readings of radon daughter concentration below or near background (0.0 - 0.03 WLs).

**August - September - October 1976**

Starting in August, the AECB undertook a more comprehensive exploratory survey. This survey confirmed that waste rock had been deposited in some parking lots, on some driveways and under a few houses. It was also discovered that some previously unaccountable readings in houses could be explained by recognizing that these houses had been constructed on a mineralized quartzite zone that contained a small proportion of uranium. Sufficient gamma activity was found, based on experience gained in Uranium City, Saskatchewan, to confirm that houses if constructed so that their foundations were in close contact with mineralized rock, then there was a high probability that significant concentrations of radon gas would enter these structures.

A total of thirty-four houses and apartments were checked in this exploratory survey. Of twenty on the quartzite zone, six had sufficient concentrations of radon daughters that interim remedial measures would be justified, using a threshold value of 0.20 WL or 50 pCi/l. Some of these measures have already been initiated. Most of the remaining, fourteen will probably require some remedial work but concentrations are not sufficiently high that action is immediately necessary.

Of the ten houses built or thought to be built on mine waste, at least seven will probably require some remedial work but again the radon daughter concentrations are such that immediate action is not necessary.

Of the four other houses, no remedial action is believed to be necessary.

All these locations will be resurveyed either as part of the immediate program or shortly thereafter.

A gamma survey of the new sub-division under construction in the western part of the town has indicated that the quartzite zone also extends into that region.

Actual values obtained from measurements in privately owned houses are not released to the public: such information is considered by the AECB to be the property of the owner or tenant,
Acknowledgments

The early and hereto unheralded work of a number of people and agencies is hereby acknowledged. These include personnel of the AEGR of Energy, Mines & Resources, both in the Elliot Lake Laboratory and in Ottawa; the Ontario Ministry of Health and a conscientious engineer from one of the mining companies.