



## YELLOWKNIFE AIR QUALITY MONITORING

### 1993 ARSENIC INTERIM DATA REPORT

The Department of Renewable Resources monitors air quality in the Yellowknife area. Participation in the National Air Pollution Sampling Network (NAPS) since 1974 provides long-term monitoring of trends in Yellowknife air quality. The Canadian Air and Precipitation Monitoring Network (CAPMoN) station, at the Snare Rapids hydroelectric site, was established in 1986 to monitor the level of acid rain transported into the area by weather systems. Continuous sulphur dioxide ( $\text{SO}_2$ ) monitoring in downtown Yellowknife was started in 1992 by Renewable Resources.

Annual air quality data reports for all monitoring programs in the Yellowknife area are available for 1989, 1990 and 1991/92. This interim data report only includes arsenic monitoring results for 1993 and early 1994. A complete report for all 1993 programs will be prepared when the laboratory results become available.

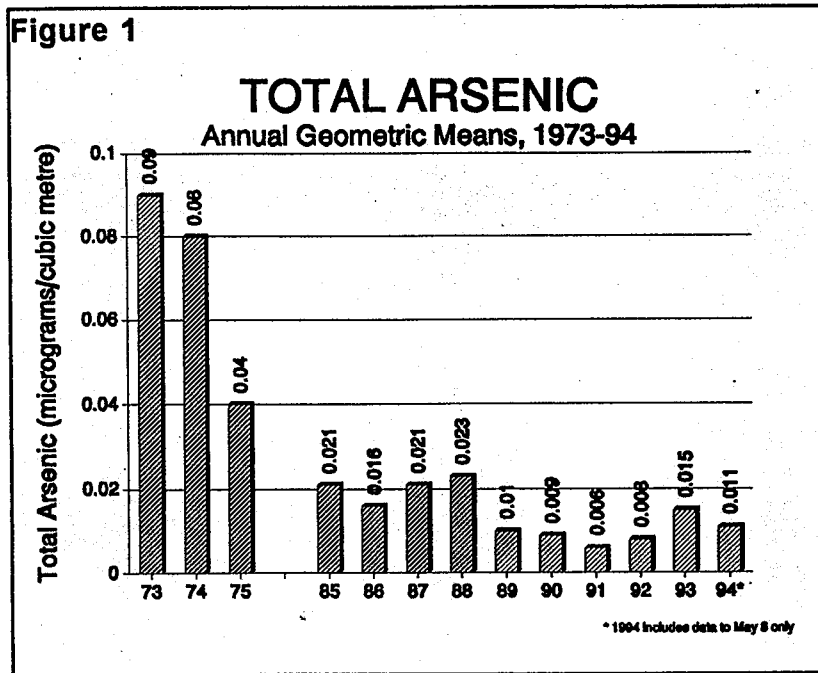
#### High volume air sampling

Atmospheric levels of total arsenic have been monitored in downtown Yellowknife since 1984 with Environment Canada's National Air Pollution Sampling (NAPS) network. Samples are taken by Renewable Resources in downtown Yellowknife on the roof of a two story building. A high volume air sampler is used to draw a measured volume of air through a filter that collects the suspended particulate (dust). Every six days a sample is collected over a 24-hour period. Filters are sent to the NAPS laboratory in Ottawa for analysis to determine the Total Suspended Particulate (TSP), lead, nitrate and sulphate levels in the dust in addition to total arsenic levels.

Figure 1 shows the annual geometric mean of total arsenic levels measured in Yellowknife from 1973 to 1994. The annual geometric mean total arsenic level in Yellowknife measured during 1993 was 0.015 micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ) and the geometric mean for 1994 samples up to May 8 was 0.011  $\mu\text{g}/\text{m}^3$ . This is an increase over levels during 1989 to 1992 when the annual means ranged between 0.006 to 0.010  $\mu\text{g}/\text{m}^3$ . However, this is considerably lower than levels in Yellowknife air during the 1970's and lower than levels measured during the mid 1980's. Measurements of total arsenic levels in 1973, 74 and 75 were made by Environment Canada.

Figure 2 shows the highest levels measured over a 24-hour period in each year. The maximum level measured in one 24-hour sample during 1993 was 0.251  $\mu\text{g}/\text{m}^3$  and in early 1994 the highest level was 0.200  $\mu\text{g}/\text{m}^3$ .

Figure 1

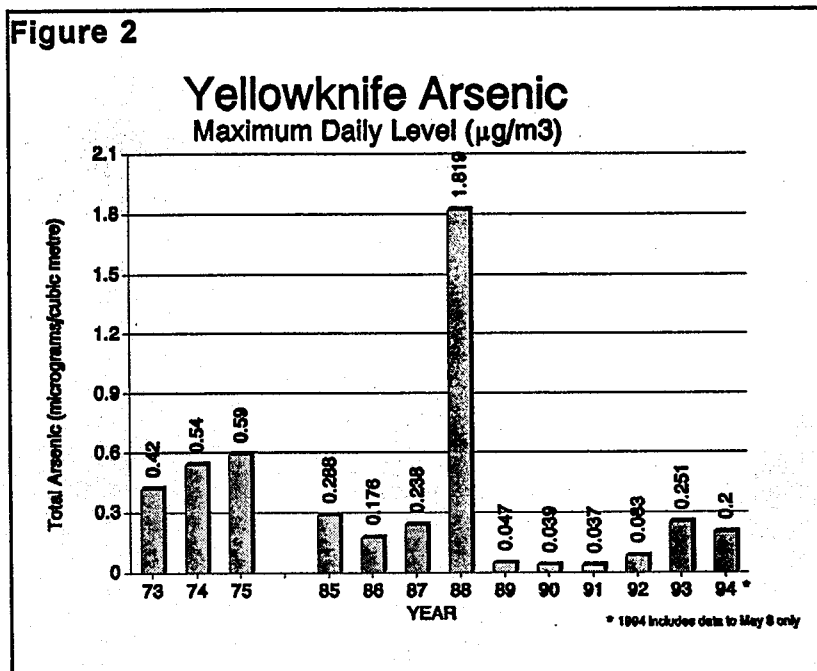


Samples have been collected since May 8, 1994 but laboratory results are not available.

Since 1985, 24-hour arsenic levels have been below the Ontario standard of  $0.3 \mu\text{g}/\text{m}^3$  except two occasions in 1988, a year that pollution control equipment malfunctions and high arsenic emission rates were reported.

Arsenic levels measured in Yellowknife dropped in the mid 1970's after arsenic control equipment used by the Royal Oak Giant Yellowknife mine was extensively overhauled. Declines in total arsenic levels in Yellowknife air since the 1970's correspond with improved maintenance and operation of that equipment.

Figure 2



### Snow survey

In March of 1994 the Department of Renewable Resources contracted a consultant to undertake a snow core survey in the Yellowknife area. Sampling locations for the 1994 survey replicated, as closely as possible, surveys conducted in 1975 and 1986. The 1994 results confirmed the previous studies, showing that Royal Oak Giant Yellowknife Gold Mine is the most significant source of arsenic in the Yellowknife area. Mirimar Con Mine did not appear to contribute significant quantities of arsenic to snow.

The snow survey examined the amount of arsenic which deposited from the air to the snow over the winter. Deposition rates to snow were determined by measuring arsenic concentrations in snow samples collected at 45 separate locations around Yellowknife. The mass of arsenic deposited (in kilograms) at each site was calculated by multiplying total arsenic concentration by volume of sample. Area (in square kilometres) was determined based on the diameter of the snow core sampling device. This calculation was then divided by the number of months during which snowfall was deposited to give  $\text{kg}/\text{km}^2$  a month.

The geometric mean of arsenic deposition rates of all sampling locations in each year is shown in Table 1. Comparing results from these snow surveys conducted in different years is not considered reliable because of variations in sampling, handling and laboratory procedures which have introduced sources of error. Deposition rates measured in 1986 were considerably lower than rates measured in 1994. This difference is not supported by results obtained through high-volume air sampling shown in Figure 1, which indicates that deposition rates in 1986 should be similar to rates measured in 1994.

**Table 1:** Geometric mean of total arsenic deposition rate for all sample sites. Deposition rates are in kilograms per square kilometres a month.

| Survey Year | Arsenic Deposition Rate |
|-------------|-------------------------|
| 1975        | 1.86                    |
| 1986        | 0.40                    |
| 1994        | 1.37                    |

An investigation of arsenic and sulphur dioxide emissions from the Royal Oak Giant Yellowknife mine was undertaken by Renewable Resources in 1991 and 1992. A report completed in 1993 can be obtained from:

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