INFORMATION REQUEST RESPONSE

EA No: 0809-001 **Information Request No: Review Board #22**

Date Received

February 14, 2011

Linkage to Other IRs

Date of this Response

June 17, 2011

Request

Preamble:
Arsenic is carcinogenic. The health impact of the project on people is an important consideration for the Review Board. The DAR attempts to show how project would affect cancer rates of people in the project area. More details on arsenic exposure are needed to compare arsenic uptakes with averages, and to contrast cancer risks with general cancer risks in the NWT. The figures in the DAR present average cancer rates for the NWT. However, cancer risks for smokers and non-smokers differ by up to an order of magnitude. Statistically, the large standard deviation from averaging the two groups, with their very different risk levels, does not meaningfully evaluate the actual risk for most people. Presenting cancer risks controlling for this variable will allow a more meaningful comparison of any increased risks from the receptors identified in the DAR.

Question*:*

1. Please provide the curve showing the statistical distribution for typical arsenic exposure in Canadian adults (indicated as a section on Fig. 8.9.5). The current graphic only indicates the range of values, not their distribution.

2. Table 8.9.2 shows the mean toxic arsenic intakes by receptors 1-4. What are the maximum estimated arsenic levels for the receptors?

3. Please provide figures that graphically illustrate relative cancer risk of study receptors (as per Fig.8.9.6) that separately indicates cancer risks for smokers and non-smokers. Describe how these separate cancer risk levels compare with the incremental lifetime risk of developing internal cancer for receptors with the highest arsenic intake in the Yellowknife area.

Reference to DAR (relevant DAR Sections)

Table 8.9.2 Estimated Intake of Arsenic by Human Receptors
Fig. 8.9.6 Comparison of Arsenic Intakes
Fig 8.9.6 Comparison of Cancer Risks

Reference to the EA Terms of Reference

S.3.4.2 Health and Human Safety

Response 1 Summary

There is no published information available to develop a statistical distribution of arsenic intakes for Figure 8.9.5.

Response 1

The information provided in Figure 8.9.5 was obtained from Table 3 of the Priority Substances List Assessment of Arsenic, prepared by Environment Canada and Health Canada in 1993. This table represents the best available data on estimated intakes of arsenic by a typical Canadian resident. The information was obtained directly from the report and is provided below in its original format. The report only provides a range of values and not distributions. To the best of our knowledge, similar information is not available from other sources and thus a distribution of arsenic exposure cannot be developed.

Estimated Average Daily Intake of Inorganic Arsenic by Canadians

Medium	Estimated Daily Intake (µg/kg-bw/day)				
	0-0.5 yr[a]	0.5-4 yr[b]	5-11 yr[c]	12-19 yr[d]	20-70 yr[e]
Water[f]	0.08	0.3	0.2	0.1	0.1
Food[g]	< 0.04-2.4	< 0.05-2.0	< 0.03-1.9	< 0.02-1.2	0.02-0.6
Air[h]	0.0003	0.0004	0.0004	0.0004	0.0003
Soil/Dirt[i]	0.03-0.08	0.02-0.05	0.006-0.02	0.002-0.005	0.001-0.004
Total	0.1-2.6	0.3-2.4	0.2-2.1	0.1-1.3	0.1-0.7
Tobacco Smoking[j]	--	--	--	0.01-0.04	0.01-0.03

a. Assumed to weigh 6 kg, breathe 2 m^3 of air per day and drink 0.1 L of water per day (EHD, 1988). Amount of soil ingested per day is estimated to be 35 mg, based on data from van Wijnen *et al* (1990), in which 0-1 year olds ingested approximately 70% as much soil as 1-4 year olds (50 mg/day).
b. Assumed to weigh 13 kg, breathe 5 m^3 of air per day, drink 0.8 L of water per day (EHD, 1988) and ingest 50 mg of soil per day based on average of values reported by Binder *et al.*, 1986; Calabrese *et al.,* 1989; Clausing *et al.,* 1987; van Wijnen *et al.,* 1990).
c. Assumed to weigh 27 kg, breathe 12 m^3 of air per day and drink 1.1 L of water per day (EHD, 1988). Due to insufficient data, soil intake estimated to be midpoint between value for 1-4 year olds (50 mg/day) and that for adults (20 mg/day), i.e., 35 mg/day.

d. Assumed to weigh 55 kg, breathe 21 m^3 of air per day, drink 1.1 L of water per day (EHD, 1988) and ingest 20 mg of soil per day (assumed to be similar to adults).
e. Assumed to weigh 70 kg, breathe 20 m^3 of air per day, drink 1.5 L of water per day, and ingest 20 mg of soil per day (EHD, 1988).
f. Based on a mean concentration of 5 µg/L; levels in most Canadian surface drinking-water supplies are considerably less than this value, although concentrations in ground water often exceed 5 µg/L (Environment Canada, 1989a; 1989b; 1989c; 1989d; OME, 1989; Manitoba Environment, 1989).
g. Estimates for age groups 0-0.5, 0.5-4, 5-11 and 12-19 years based on concentrations in various food groups presented in Dabeka *et al.* (1987) and food consumption patterns data (Nutrition Canada, 1977). Estimated intake for 20-70 year olds from Dabeka *et al.* (1987). It is estimated that 37% of the arsenic content of food is inorganic; although the percentages of total arsenic which is inorganic were available for several food groups, it was not possible to determine the contribution of each food group to total dietary intake of inorganic arsenic, as these groups did not match the composites analyzed in the duplicate diet survey of Dabeka *et al.* (1987). Insufficient data were identified to estimate intake of arsenic by infants in breast milk.
h. Based on the mean airborne arsenic concentration of 0.001 µg/m^3 in most Canadian cities surveyed (Dann, 1990).
i. Based on range of mean arsenic levels in various Canadian soil types of 4.8 to 13.6 ppm (Kabata-Pendias and Pendias, 1984). It was assumed that all of the arsenic present in soils is inorganic.
j. Based on estimated arsenic content of mainstream cigarette smoke ranging from 40 to 120 ng per cigarette (U.S. DHHS, 1989) and 20 cigarettes smoked per day.

Response 2 Summary

In addition to the mean, the maximum arsenic intakes were calculated in the risk assessment and are approximately twice the mean intakes.

Response 2

The human health risk assessment was done in a probabilistic fashion and mean, median, 5th percentile and 95th percentile arsenic intake values were calculated. The 95th percentile of the distribution is considered to be a reasonable maximum estimate of arsenic exposures and essentially represents the maximum intake. From the values presented below, it can be seen that the 95th percentiles are approximately double the mean values.

Receptor	Total Arsenic Intake(mg/kg/d)			
	5th	Mean	Median	95th
1a.Townsite - adult	$3.7x10^{-4}$	$8.8x10^{-4}$	$8.1x10^{-4}$	$1.6x10^{-3}$
1c.Townsite - child	$8.4x10^{-4}$	$1.6x10^{-3}$	$1.5x10^{-3}$	$2.7x10^{-3}$
2a.Latham Is. - adult	$4.0x10^{-4}$	$7.7x10^{-4}$	$6.7x10^{-4}$	$1.5x10^{-3}$
2c.Latham Is. - child	$7.0x10^{-4}$	$1.3x10^{-3}$	$1.1x10^{-3}$	$2.5x10^{-3}$
3a.Yellowknife - adult	$2.3x10^{-4}$	$6.7x10^{-4}$	$6.1x10^{-4}$	$1.3x10^{-3}$
3c.Yellowknife - child	$6.2x10^{-4}$	$1.3x10^{-3}$	$1.2x10^{-3}$	$2.3x10^{-3}$
4a.Dettah - adult	$3.3x10^{-4}$	$5.6x10^{-4}$	$4.8x10^{-4}$	$1.1x10^{-3}$
4c.Dettah - child	$5.7x10^{-4}$	$1.0x10^{-3}$	$8.3x10^{-4}$	$2.0x10^{-3}$

Response 3 Summary

The information required to complete an analysis of cancer for smokers versus non-smokers is not available.

Response 3

The general cancer risk values that are presented in Figure 8.9.6 of the Developer's Assessment Report were obtained from Statistics Canada for the general population. To the best of our knowledge, smoking prevalence data are rare and therefore the age-adjusted rates that would be necessary to develop risks for smokers and non-smokers, and to compare with the lifetime risk for receptors with the highest arsenic intake, are not available.