

Sudbury Human Health Risk Assessment Briefing

September 22, 2008

Prepared by Environmental Defence



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The following report was commissioned by Mine-Mill Local 598CAW and Local 6500 Steelworkers in July 2008, to review the Sudbury Soil Study Human Health Risk Assessment.

Environmental Defence is a national non-profit organization that seeks to connect Canadians with key environmental, human health, and pollution issues. We focus on creating hard-hitting campaigns that result in real change and educate the public on issues such as, climate change, clean air and water, and toxic chemicals.

Since 2005, Environmental Defence has been testing the bodies of Canadians for measurable levels of pollutants as part of its Toxic Nation campaign. The testing of Ontario political leaders – Premier Dalton McGuinty, Progressive Conservative Leader John Tory and NDP Leader Howard Hampton revealed high levels of toxic chemicals from sources such as consumer products and industrial processes. The Toxic Nation campaign continues to undertake research and advocacy to strengthen pollution laws across the country.

The following review was undertaken by Dr. Kapil Khatter, acting for Environmental Defence. Dr. Khatter is a family physician and environment and health expert who has led chemical-related policy work at Environmental Defence. He has a Master's degree in Environmental Studies and has sat on a number of working groups tasked with providing expert advice to Health Canada and Environment Canada. He has scientific and policy expertise related to the environment and health, with a unique perspective that comes from being a physician.

For the past couple of years, Dr. Khatter has worked on the review of Canada's national pollution law, the Canadian Environmental Protection Act, and on the federal government's Chemicals Management Plan.

Key points

1. Lead contamination was found to be above safe levels in four communities. The consultants' recommended target soil lead levels for clean up, but recent research shows that some children may be harmed at these levels. In addition, lead is a probable carcinogen with no known threshold and therefore even the recommended maximum levels of exposure may increase cancer risks.
2. Air levels of nickel are higher than recommended exposure limits for non-cancer and cancer effects in three communities. The assessors dismissed the risk saying the assessment had a margin of safety. The margin of safety is meant, however, to compensate for the gaps and uncertainties inherent in the assessment and it does not mean that there is no significant risk.
3. Both soil and inhaled arsenic levels are significantly increased throughout most of the Greater Sudbury Area (GSA). Urinary arsenic levels were not found to be higher than in control communities because purchased food is the main source of exposure. There are still concerns that inhaled arsenic and specific types of ingested arsenic may put GSA residents at increased risk.
4. Food grown in the GSA tended to have higher levels of lead, nickel and arsenic, sometimes more than 10 times the levels store-bought food. These higher levels are a concern for those eating local food as they increase these residents overall exposure level.
5. The assessment excludes the extra risk to workers living in the GSA who have occupational contact with the metals of concern in addition to the exposure non-workers get. The assessment assumes that it is acceptable to expose workers to greater levels of risk.
6. The risk assessment cannot demonstrate that no harm is occurring; it can only estimate the level of risk. The assessors have inappropriately decided what that acceptable level of risk should be. This is a decision the community should make.

The assessment

The Sudbury Human Health Risk Assessment was undertaken by the Sudbury Area Risk Assessment Group (SARA) starting in 2003. It was based on soil sampling data from the Sudbury Soils Study funded by the Ontario Ministry of the Environment (MOE) and local mining companies. The metals chosen for the human health assessment were those found to be contaminating the entire Greater Sudbury Area, to be above MOE soil guidelines, and those that at least in part come the local mining and smelting operations.

Communities of interest (COIs) were chosen from within the soil study area, including Sudbury Centre, Falconbridge, Coniston, and Copper Cliff. Hanmer was used a control community, considered unaffected by the emissions, as well as residential Toronto.

The study attempted to look at all sources residents might have of the metals under study, including through air, food, water, etc. The assessors also attempted to evaluate the impact on different age groups within the air and specifically at the risks to hunters/anglers and First Nations individuals. New research was undertaken to fill some of the data gaps that existed. A food consumption survey, air level monitoring, drinking water sampling, an indoor dust survey and testing of local food levels were done.

This briefing note is an evaluation of the human health risk assessment and the conclusions made. The results presented focus on lead, nickel and arsenic, the three metals that have cancer-causing potential and that are not essential in the human diet.

The case for the other three metals is more difficult to make. Although selenium exposure is high, the majority of it comes from food bought at the grocery store. And it is not clear at what point healthy amounts of selenium become harmful ones. Cobalt may actually be carcinogenic, and nickel exposure may make people sensitive to cobalt. It is difficult, however, to determine how much cobalt is too much given the state of the science.

The assessors did not find a significant increased risk of exposure for First Nations populations or for non-First Nation hunters or anglers as contamination of game and fish as not a major source of exposure. The note will therefore not focus on these populations.

The results

Lead. Maximum soil levels for lead were above recommended soil exposure limits in Copper Cliff, Coniston, Sudbury Centre and Falconbridge. The potential exposure from skin, oral and inhaled sources was found to be above regulatory safe limits for non-cancer effects. Though lead is considered a “probable carcinogen,” a risk assessment was not done for lead’s cancer-causing effects because its carcinogenic effects are poorly understood.

The consultants’ analysis of an appropriate soil level for lead concluded that 400 micrograms per gram would be protective of human health. They recommended blood lead testing as a way of gathering more accurate information about lead exposure.

Nickel. Levels of inhaled nickel were higher than non-cancer exposure limits at the Copper Cliff, Falconbridge and Sudbury Centre West monitoring stations (particularly Sudbury Centre West). Inhaled nickel is considered to be carcinogenic as well, but there are insufficient data to know how cancer-causing oral or skin-absorbed nickel is. Nickel is also a sensitizer and a significant percentage of the population reacts to nickel but there was no evaluation done of how local nickel pollution impacts this.

The levels of inhaled nickel exceeded benchmark regulatory standards for both cancer and non-cancer endpoints. The assessors, however, dismiss the excess exposure as unlikely to cause harm given the margin of safety built into the assessment.

Arsenic. Arsenic intake, both orally and through skin, was above non-cancer exposure limits for all areas except Sudbury Centre. Falconbridge had particularly high soil arsenic levels with the mean residential concentration being 18 times that of those in Hamner.

The risks of cancer from arsenic inhalation for all of the communities being studied were found to be greater than the accepted regulatory one in a million risk. The cancer risks ranged from 1.3 in 10,000 in Coniston to 2.5 in 10,000 in Falconbridge, compared to their calculation of the typical Ontarian risk at 5.5 in 100,000 (4-5 times as high). It is unclear whether there is a non-cancer risk from inhaled arsenic as these risks were not calculated because there are no regulatory standards.

The risk from arsenic exposure was considered to be unimportant based on the additional Falconbridge arsenic study which found comparable urinary levels with those of residents of Hamner. This is likely because the majority of ingested arsenic comes from store-bought food though there may be differences in the type of arsenic. Increased risks from inhaled arsenic may not be represented by urine levels if the arsenic stays in respiratory tissues the way nickel does.

Assessment choices

There are a number of findings that the assessors felt unconcerned about because of the margin of safety built into the assessment. Nonetheless, in doing the assessment there were many gaps and assessment choices that decrease the margin of safety and make the assessment less likely to find a problem. These include:

1. Removing the “outliers” in the soil measurements. In evaluating the soil concentrations of the metals in various locations, the assessors decided to ignore the highest readings out of statistical convention. Presumably this is to keep results that are inaccurate or not representative of the normal range of concentrations out of the calculations. What this does however, is leave out the most contaminated spots, where the risk would be highest.
2. In determining what contribution mining and smelting makes to the soil levels of metals in the area, the assessors subtracted the expected background concentrations, or the concentrations that would likely be there if there was no additional pollution. The background concentrations used were not averages though, they were the 98th percentile, or almost the maximums found. This would underestimate the amount that local industry contributes.
3. The Ministry of the Environment required the consultants to use the existing standards of typical regulatory agencies like Health Canada and the Environmental Protection Agency no matter how old they are. They were not allowed to use newer data that may show more of a risk. (On the other hand, they could not use new data that pointed to

more confidence in safety either). In the worst case, the lead standard used was developed in 1996 while it is clear that recent evidence points towards a stricter safe level.¹

4. Lead is considered a “probable carcinogen” by the US EPA and the International Agency for Research on Cancer. There remains, apparently, a lack of understanding of lead metabolism and carcinogenicity. As a result, the assessors decided not to include lead’s risk “as a carcinogen for oral or inhalation exposures” in the assessment.
5. The assessors point to the lack of research on the interactions between metals and with other pollutants, but conclude that synergistic interactions (interactions which enhance effects rather than just adding to them) have been rarely found at the levels of exposure seen. They then leave the potential for multiple exposures to different metals out of the assessment. This has the potential to greatly underestimate risk assessments if there are additive or synergistic interactions not accounted for. Lead and arsenic for example, may be more than additive when affecting the nervous system.
6. The assessment takes a route by route approach to each of the metals. In other words, inhaled nickel is compared to standards for inhaled nickel; ingested nickel is compared to standards for ingested nickel. Each of these standards, however, is developed without accounting for additional exposures through other routes. The assessors do not look at how the total exposure from all routes may cause risk and therefore the risk may be underestimated.

Other comments

The assessors contradict themselves when establishing 400 micrograms per gram of soil of lead as an acceptable level for the GSA. The assessment explains that even 5 micrograms per decalitre of lead in children’s blood has not been established as safe and that there is emerging evidence that lower levels may cause harm to development. For instance, a recent study in *Environmental Health Perspectives* reported that children with a blood lead level greater than 2 microgram per decalitre had a four fold increased chance of having attention-deficit hyperactivity disorder.²

They also present evidence that soil levels as low as 75 micrograms per gram of soil could result in 5% of children reaching that 5 micrograms per decalitre level. Still, they base their recommendations for soil levels on existing international standards that do not reflect what we know now about lead. Based on their own evidence, their recommended level of 400 micrograms per gram would expose well over 5% of GSA children to potentially harmful levels of lead.

The drinking water in Falconbridge was switched from an old well to a newer deeper well in the summer of 2005. The new well’s lead levels are “greatly decreased” from the levels

¹ The MOE’s recommended intake for lead is based on this out of date health standard for lead. According to the assessment, the US EPA believes that lead’s effects may happen at levels so low that there is likely no safe threshold.

² Braun JM, Kahn RS, Froehlich T, et al. Exposures to environmental toxicants and attention deficit hyperactivity disorder in US children. *Environmental Health Perspectives* 2006;114:1904-9

in the older well and those are the data used in the assessment (though little sampling has been done so far). Nevertheless, Falconbridge residents would have bone levels of lead affected by the older well levels. At times of life when bone is breaking down, these bone levels can affect health, by increasing blood pressure for instance (pregnancy, menopause, aging). The assessment of current and future lead exposure should take into account the impact of past exposure.

The Agency for Toxic Substances and Disease Registry in the United States estimates that 10-15% of the American population have become sensitized to nickel (have skin reactions). One would guess that Canadian levels are not that different. The assessors were unable to determine a threshold for nickel sensitization. Instead, the risk of sensitivity to nickel as a result of pollutants is ignored as a reason to limit nickel pollution.

Based on comparisons to the Canadian diet study, food grown in many parts of the GSA had levels of lead, arsenic and especially nickel sometimes greater than ten times higher than typical Canadian levels. This did not show up as an important risk because the food eaten in the area comes primarily from elsewhere. The risk could change dramatically for anyone growing and eating a large percentage of their own food.

At a minimum, the recommendations based on the assessment should alert residents to the high levels of contamination in locally grown food so that they know the potential risks of garden grown vegetables and can choose to minimize their exposure. A ban on growing local vegetables might be considered given their level of contamination. Given there is no known safe level of lead for children, feeding them vegetables with ten times the normal levels of lead seems a poor health choice.

As with much of human health risk assessment in Canada, workers' exposures are excluded as a source of risk. There is no attempt in the assessment to determine the risks of environmental exposure to workers who also have occupational exposures. Their combined exposure makes them a vulnerable population and in need enhanced protection. Instead, the assessment states that: "different levels of 'acceptable' risk are assumed for employees in the workplace compared to a resident of the general Sudbury population"³ In other words, it is considered acceptable for workers in the GSA to have increased risks of illness from metal exposure.

The consultants' conclusions go beyond the science to subjective opinions on whether the risks are low enough. The documents themselves state that: "the selection of an acceptable risk level is predominantly a policy-based, rather than a science-based, decision," and that "an alternate acceptable risk level may be appropriate"⁴

A few pages later, however, they write that: "Where estimated risks ... are less than the acceptable level, it can be concluded that no observable adverse health effects would be expected to occur including sensitive subpopulations or groups."⁵ This is not accurate.

³ Page 6-12

⁴ Page 4-116

⁵ Page 4-119

Sudbury Human Health Risk Assessment by Environmental Defence

Even low risk does not mean no risk, nor does it mean that no one gets harmed. This is especially true for carcinogens that may not have safe thresholds. In addition, these are “risk estimates” and so are not assurances that there are no health effects, only probabilities. The assessors’ conclusions therefore go beyond what a risk assessment can and should do. They decide the acceptable level of risk for the community, which should be a community decision. And they propose to assure residents that no harm at all is occurring, which the assessment can not do.