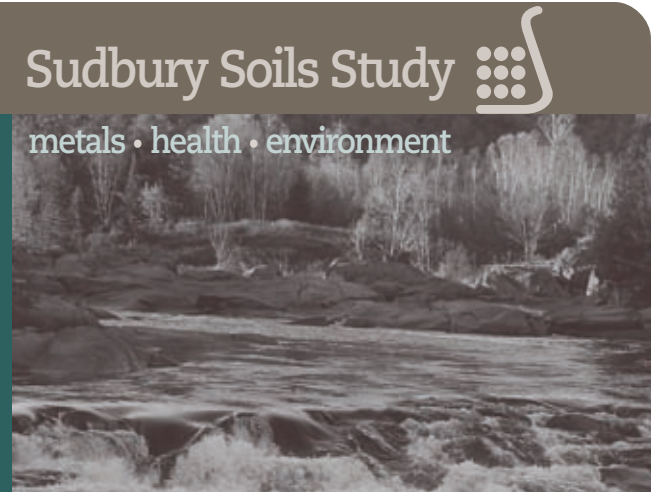


Ecological Risk Assessment RESULTS



Results Announced in Sudbury

After seven years of intensive fieldwork and data analysis, the Technical Committee overseeing the Sudbury Soils Study is releasing **Volume III: Ecological Risk Assessment (ERA)**, the final volume of the study. The ERA assessed current conditions in the Sudbury environment to understand the ecological impacts of metals in soil from historic mining and smelting activities.

The results of the ERA technical report were presented to the public at a community information session held at Science North in March 2009.

Conclusions and background information from the ERA are summarized here for general information. For a more detailed discussion of the results, the full technical report and a summary report are available for public review at all branches of the public library in the Greater Sudbury area.

All reports contained in the Sudbury Soils Study can also be viewed online at www.sudburysoilsstudy.com.

The Sudbury ERA

The ERA is the ecological component of the Sudbury Soils Study, which is considered to be one of the largest risk assessments ever conducted in Canada.

The soils study was initiated in 2001, and a Technical Committee (TC) was formed to oversee the process. The TC includes representatives from the Ontario Ministry of the Environment (MOE), the City of Greater Sudbury, the Sudbury & District Health Unit, Health Canada First Nations and Inuit Health, Vale Inco, and Xstrata Nickel. The purpose of this multi-stakeholder project was to determine whether metals in the study area pose a potential risk to humans, plants, or animals.

The complete Sudbury Soils Study comprises three volumes:

- Volume I: Background, Study Organization and 2001 Soils Survey;
- Volume II: Human Health Risk Assessment (HHRA); and
- Volume III: Ecological Risk Assessment (ERA).

Volumes I and II (Background and HHRA) were released to the public in May 2008. This newsletter provides an overview of the findings contained in Volume III: Ecological Risk Assessment (ERA), released in March 2009. The ERA was conducted on behalf of the TC by the Sudbury Area Risk Assessment (SARA) Group, a team of independent scientists and experts in the field of assessing risks related to industrial activity. The study examined potential impacts to the terrestrial (land-based) plant community and to wildlife in the study area, with the following goals:

1. To evaluate the extent to which the COC (metals from smelter emissions) are preventing the recovery of regionally representative, self-sustaining terrestrial (on land) plant communities,
2. To evaluate risks to terrestrial wildlife populations and communities due to COC, and to evaluate risks to individuals of threatened or endangered species due to COC.

ECOLOGICAL RISK ASSESSMENT Objectives and Conclusions

The Technical Committee's goal for the ERA was to characterize the current and future risks to the environment from metals related to smelter emissions. In addition, the study sought to provide information to support activities related to the ongoing recovery of natural, self-sustaining ecosystems in areas that have been affected by smelter emissions.

The primary objectives and conclusions of the detailed ERA Technical Report are summarized as follows:

	OBJECTIVE	CONCLUSION
1	Evaluate the extent to which Chemicals of Concern (COC) are preventing the recovery of regionally representative, self-sustaining terrestrial plant communities	Terrestrial (land-based) plant communities in the Greater Sudbury area have been and continue to be impacted by metals in soil. Terrestrial plant communities in the Greater Sudbury area are also impacted by soil erosion, low nutrient levels, lack of soil organic matter, and/or low soil pH.
2	Evaluate risks to terrestrial wildlife populations and communities due to COC	COC from smelter emissions are not currently exerting a direct effect on wildlife populations in the Greater Sudbury area, nor are they predicted to in the future. However, historic impacts of smelter emissions on plant communities have affected habitat quality and, therefore, may be having a continued indirect influence on birds and mammals in the study area.
3	Evaluate risks to threatened or endangered terrestrial species due to COC	There are very few recognized threatened or endangered species in the study area. There is no evidence that COC from the smelters are having a direct effect on these species.
4	Conduct a comprehensive problem formulation for the aquatic and wetland environments in the Sudbury area	An aquatic problem formulation was developed as an information gathering and interpretation stage to focus the approach for a possible future detailed aquatic ecological risk assessment.

Results from the ERA field studies were applied to the larger Sudbury region using satellite imagery. This approach was used to classify areas of vegetation that were potentially impacted from historical activities and smelter emissions, and where natural recovery continues to be at risk. Within the areas that could be classified using this approach, approximately one half of the vegetation was identified as moderately to severely impacted. Further field and confirmation studies are required to validate these findings and to confirm areas for restoration and greening activities.

What is an Ecological Risk Assessment?

The term risk refers to the chance or likelihood that a particular event will occur. Ecological risk assessment (ERA) is a formal analytical process that evaluates the likelihood that plants or animals may experience adverse effects from exposure to particular chemicals in the environment.



Martindale Road, late 1970s



Photo Credit: Keith Winterholder

Martindale Road, 2001

The Sudbury area ERA was unique in many ways. First, it was recognized from the beginning that wide-scale impacts to the area landscape had occurred as a result of over 100 years of human activities including smelter emissions. Also, smelter emissions of metals were recognized as one of many sources of stress to the local vegetation.

Historically, widespread logging activities, sulphur dioxide emissions from roast yards and early smelters, soil erosion, and forest fires have also contributed to the current environmental conditions. In addition, the surrounding ecosystem is improving significantly as a result of emissions reductions and over 30 years of re-greening and restoration activities.

Terrestrial Ecosystems: A community of organisms and their environment that occurs on the land.

Aquatic Ecosystems: A community of plants and organisms that exist naturally in bodies of water.

Identifying the Chemicals of Concerns (COC):

The TC assigned a screening process to identify the Chemicals of Concern (COC) that would be analyzed in the ERA. To be a COC, each metal must:

- be present at levels higher than the Ontario Ministry of Environment (MOE) soil quality guidelines, or the typical Ontario background level.
- be present across the study area; and
- be associated with the mining companies' operations.

This screening process identified seven Chemicals of Concern (COC) to be studied in the ERA: *arsenic, cadmium, cobalt, copper, nickel, lead and selenium.*

Valued Ecosystem Components

Since it is not possible to assess risks to every plant and animal species present in a study area, representative species are selected for detailed evaluation. These groups of species are known as *valued ecosystem components (VECs)*. Each VEC is selected to

represent a larger feeding group, also known as trophic levels.

Trophic Level: noun Ecology, any class of organisms that occupy the same position in a food chain.

Selection criteria were applied to species lists and a total of 12 VECs were identified for the terrestrial ERA. Sudbury area residents were also invited to attend workshops to provide feedback on the VECs selected for the study. The result was a list of ecosystem components considered to be representative of the area and the natural food chain of *producers* and *consumers*.

VECs for the ERA:

- | | |
|----------------------------------|----------------------|
| 1. Plant communities | 6. White-tailed deer |
| 2. Blueberry | 7. Moose |
| 3. Soil invertebrate communities | 8. Red fox |
| 4. Northern short-tailed shrew | 9. American beaver |
| 5. Meadow vole | 10. American robin |
| | 11. Ruffed grouse |
| | 12. Peregrine falcon |



Weight of Evidence: A Comprehensive Approach

Depending on the VECs being assessed, several types of information (*lines of evidence*) can be collected to aid in the evaluation of risk. In science, this is known as a Weight-of-Evidence approach.

The lines of evidence considered in the ERA include:

- **Field studies** – detailed vegetation studies were conducted to physically examine the condition of local plant communities;
- **Toxicity studies** – to test whether plants and animals (earthworms, for example) can survive, grow, and reproduce in the soil;
- **Soil characterization studies** – to determine whether the physical and chemical nature of the soil may be having an effect on local plants and animals;
- **Published scientific literature** – documented studies and information on the VECs, COC, and/or the study area; and
- **Regulator supported numeric risk calculations from an industry standard ERA framework.**

Data gathered from each of these lines of evidence were considered in the evaluation of risks to the study area environment.

Plant Community Survey

A total of 18 test sites were studied for the ERA, at varying distances from the smelters. In addition, three reference sites were chosen to represent areas that had not been impacted by COC from mining activities. Metal concentrations in soils at the reference sites are assessed as local *background levels* (levels that might naturally occur in the area, without the influence of human activity).

For the plant community assessment, the SARA group collected detailed information for study sites including:

- Soil physical and chemical characteristics;
- Soil toxicity;
- Ecological plant community structure and condition; and
- The general functioning of the soil invertebrate and microbial communities.

Plant Community: a combination of plant species (trees, shrubs, grasses, herbs) that form the natural vegetation for a specific area. Plant communities provide habitat for animals and affect soil chemistry as they decompose.

A comprehensive terrestrial plant community assessment was conducted to determine the relative impact of COC on vegetation of the test sites. Most of the sites were classified as moderately or severely impacted.



The above photographs compare plant communities at a healthy site (left) with those of an impacted site (right). The plant community at the healthy site had 75 different species present compared with only 21 species at the impacted site.

In general, a greater number of plant species means a healthier ecosystem. The number of species within the test sites tended to increase with distance away from the smelters.

Soil Characterization

Overall, most of the test soils were classified as moderately or severely impacted due to soil erosion, poor fertility, poor nutrient balance or limited capacity to retain water.

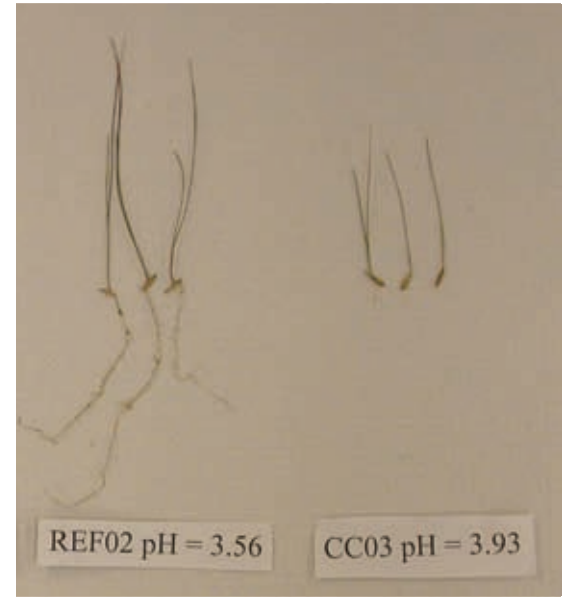


The above two photos illustrate the soil profile at two different sites. The soil profile on the left is considered to have low or no impact because it shows an organic layer that is necessary to support plant growth. In contrast, the soil profile on the right is considered severely impacted, since it has little to no organic layer. Metal levels in soil tended to be higher in soils closer to the smelters. However, concentrations of metals (COC) were not directly evaluated in the soil characterization line of evidence.

Soil Toxicity Testing

The results of toxicity tests conducted with plant and earthworm species in soil from the test sites were compared to the equivalent data for the reference or non-impacted sites.

This photograph (below) compares the root and shoot growth of Northern wheatgrass grown in soil from a reference site (left) to one grown in soil from an impacted test site (right). This example illustrates that growth of northern wheatgrass was significantly reduced and was influenced by levels of metals found in the soils. Toxicity tests were also conducted in soil where the pH was raised by adding lime. Raising the pH reduced the toxicity of the soils and was more beneficial in soils closer to the smelter.



Understanding the Vegetation Results

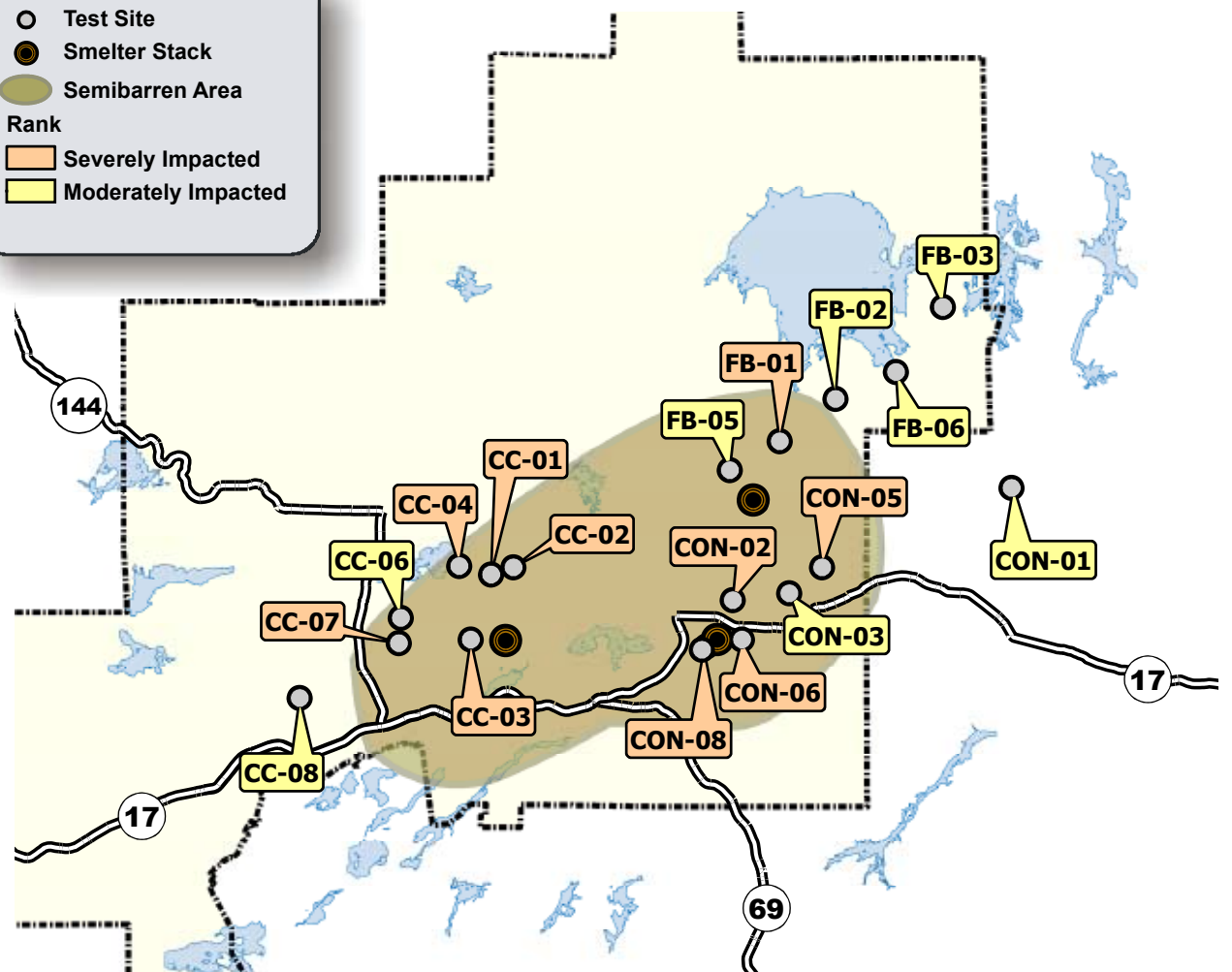
Based on the findings of the ERA, we know that terrestrial (land-based) plant communities in the Greater Sudbury area have been impacted by metals in soil. Science also tells us that other factors such as soil erosion and pH levels may also play a role in the future sustainability of local ecosystems.

The study scientists produced site rankings that describe the level of impact observed at each of the sites. Sites were given one of three possible ranks to denote the level of impact (relative to the reference sites):

- Green (low to not impacted),
- Yellow (moderately impacted) or
- Red (severely impacted).

This map (right) shows the location of the test sites within the study area, with colour codes for each level of impact. The elliptical shaped area is known as the semi-barrens area. The term was first used in the mid-1970s to describe an area where the vegetation had been impacted by industrial activities and smelter emissions. The ERA results indicate that some impacts to the plant community also extend beyond this area.

- Test Site
- Smelter Stack
- Semibarren Area
- Rank**
- Severely Impacted
- Moderately Impacted



Test Site Rankings for the Plant Community Assessment

Ongoing emissions reductions and greening efforts over the past three decades continue to achieve significant improvement in the local environment of Greater Sudbury. The ERA

represents an important tool to help scientists, risk managers, and members of this community to focus their efforts to meet future recovery goals.

Terrestrial Wildlife Assessment

In assessing risks to plants and animals, scientists consider each of the *exposure pathways*, or the ways in which these receptors might be exposed to chemicals in the environment. Plants may be exposed through direct contact with soil and air, while animals may be exposed through ingestion of soil, plants and other organisms.

The wildlife exposure assessment used mathematical equations, or *models*, to estimate the total exposure of each animal to each of the metals being studied. The exposure models combine all of the available information about the species and COC levels. The use of Sudbury-specific information is critical at this stage to make the most accurate exposure estimates possible.

Based on all of the information considered in the ERA and the conservative nature of the risk models and scientific assumptions, it is unlikely that metals in soil are having a significant effect on terrestrial wildlife populations in the Greater Sudbury area. However, historic impacts of smelter emissions on habitat quality (loss of some plant species used as food or habitat) may be having a continued effect on some birds and mammals in the study area.

Additional Information

Copies of the full technical report (Volume III Sudbury Area Ecological Risk Assessment) are available for viewing at the offices of the Ontario Ministry of the Environment at 199 Larch Street, Sudbury, and at the public libraries in Greater Sudbury. Electronic copies of the entire technical report and other information regarding the study are available on the website at www.sudburysoilsstudy.com.

The ERA Summary Report is also available at the above locations, or requests for copies may be made by phone: 1.866.315.0228.

For information, contact:

Ontario Ministry of the Environment
1.705.564.3237

Sudbury & District Health Unit
1.866.522.9200, ext. 240

Health Canada
1.705.671.0760

City of Greater Sudbury
311 or 705.671.2489

Vale Inco
705.662.INCO (4626)

Xstrata Nickel
705.693.2761

Have your say contact us

ERA Public Comment Period – April 3 to September 4, 2009:

Members of the public are invited to review the ERA report and submit written comments during the Public Comment Period: April 3 to September 4, 2009.

The study team will review all comments submitted during this period. To receive a published response, all comments must be relevant to the contents of the ERA Report, and must be submitted in writing before 11:59 pm on September 4, 2009, accompanied by the name, address and phone number of the individual submitting the comment(s). Responses to relevant public comments will be published as an Appendix to the final ERA Report.

How to submit your comments on the ERA:

- By MAIL: Sudbury Soils Study – ERA Public Comments
c/o AECOM Limited, 512 Woolwich St., Suite 2
Guelph, Ontario N1H 3X7
- By FAX: 1.519.763.1668
- By EMAIL: comments@sudburysoilsstudy.com
- By INTERNET: www.sudburysoilsstudy.com (online comment form provided)

The Path Forward

Enhancing Biodiversity for the Future of Sudbury

The Ecological Risk Assessment has confirmed that there is more work to be done to support environmental recovery throughout the Greater Sudbury area. So what happens next?

The City of Greater Sudbury, Vale Inco and Xstrata Nickel have developed a *Risk Management Framework Report for Greater Sudbury* that will focus on increasing efforts to address biodiversity throughout the region. This report, which responds to the results of the ERA, is available on the website at www.sudburysoilsstudy.com.

In 2009, the City and the mining companies will work in cooperation with local stakeholders to develop a *Biodiversity Action Plan for Greater Sudbury*. This plan will provide a roadmap for the future, setting goals and priorities for regreening the local environment. The process will be coordinated by the City's Environmental Planning Initiatives Section, with guidance from VETAC, Council's advisory panel responsible for oversight of its Regreening Program.

Local environmental interest groups will be invited to participate in the development of this strategy. Facilitated workshops, surveys and other opportunities will be provided to ensure the strategy is aligned with community needs and priorities.

Both local mining companies are committed to the development of this strategy over the long term. The companies will provide ongoing financial and technical support for intervention activities, monitoring programs and research that aim to establish regionally-representative, self-sustaining terrestrial plant communities throughout Greater Sudbury.

Biodiversity: the variety and variability among living organisms and the ecological communities they inhabit.

Get Involved!

To learn more about how to become involved in the future of Sudbury's re-greening initiatives, contact the City at (705) 674-4455 ext. 4605 (Regreening Program) or (705) 674-4455 ext. 4297 (Environmental Planning Initiatives), or by email at regreening@greatersudbury.ca.

For general information on the City's environmental programs, visit the website at www.greatersudbury.ca



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