summer/fall 2006

update

Sudbury Soils Study
metals • health • environment

Technology Lights the Way!

Canadian Light Source Uses Synchrotron to Identify Metal "Species"

Panoramic view of the Storage Ring and HXMA beamline.

Measuring the levels of metals in the environment is a detailed, time-consuming process. To make that process even more complex, scientists must not only look at the total amount of metals, but also the chemical form or *species* of some metals detected.

For instance, nickel is found in several different forms in the environment including nickel oxide and nickel subsulphide. These nickel species share many of the same properties. However, in determining potential risks to human health, they are quite different.

Nickel oxide, the form of nickel most commonly released from smelter activities, is not linked to serious health effects under normal exposure circumstances. The other species, nickel subsulphide, may contribute to some forms of cancer when inhaled at elevated levels over long periods of time.

To provide more information on nickel speciation, the study team for the Sudbury Soils Study sent air filter and soil samples to Canadian Light Source (CLS) Inc., one of the only facilities in Canada with the technology and expertise to distinguish between different chemical forms of nickel. CLS analyzed the samples using a method called X-ray Absorption Near-Edge Structure (XANES) Spectroscopy, employing a piece of equipment called a synchrotron.

A synchrotron produces an extremely bright light—millions of times brighter than the sun—by using powerful magnets and radio waves to accelerate electrons to nearly the speed of light. Using this technology, scientists are able to select different parts of the light spectrum to see microscopic matter, right down to the level of the atom.

This relatively new technology is considered state-of-the-art. In fact, it has become so popular in the past few years that CLS's customers often have to wait several months to receive their results.

For the Sudbury Soils Study, CLS responded quickly and the synchrotron was able to determine the chemical forms of metals in the Human Health Risk Assessment (HHRA) samples. This information helped the study team to further refine the HHRA results and to more accurately assess potential health risks.

CLS is Canada's national facility for synchrotron light research. Opened in October 2004, CLS is leading the way to a new era of science and innovation in Canada. Located on the university campus in Saskatoon, Saskatchewan, the $173.5-million project is Canada's biggest scientific research facility to be developed in more than 30 years.

Information obtained with a synchrotron can also help to design new drugs, develop more effective motor oils, and build more powerful computer chips.

Study Update

Assessing the Sudbury environment

Data collection is now complete; a draft of the Human Health Risk Assessment (HHRA) has been submitted to TERA (Toxicology Excellence for Risk Assessment), an independent body that is coordinating the international scientific peer review of the Sudbury Soils Study reports. On September 21st and 22nd, members of the expert review panel will be meeting with the SARA Group (the study team that conducted the data collection and analysis, and drafted the report) and the Technical Committee in September to discuss the HHRA. The draft report of the Ecological Risk Assessment (ERA) is nearing completion and expected to be submitted for peer review later this year.

When the final reports are completed early next year, they will include input from some of the world's leading scientific experts. The public will also have an opportunity to review the reports and provide comments.

With more than three years of research and thousands of data points, the report is expected to be a very large document divided into three volumes:

- Vol. 1 - Historical and background information;
- Vol. 2 - Human Health Risk Assessment (HHRA); and
- Vol. 3 - Ecological Risk Assessment (ERA).

A plain language summary will also be provided.

To review the table of contents for each volume of the Sudbury Soils Study reports, please visit our website at www.sudburysoilsstudy.com.

For more information on the Sudbury Soils Study report, call us toll-free at 1-866-315-0228, visit the website or email us at questions@sudburysoilsstudy.com.

Public Briefing: Look inside for details.

For more information on Canadian Light Source, visit their web page at www.lightsource.ca.

Meet the Peer-Review Panel

In early July, the Technical Committee (TC) reached an important milestone and took a big step toward completion of the Sudbury Soils Study.

The TC has submitted the first two draft reports of the Study to TERA (Toxicology Excellence for Risk Assessment), the firm retained to coordinate a technical review by an Independent Expert Review Panel (IERP). The review panel is comprised of internationally recognized scientists who are experts in the field of human health risk assessments (HHRAs). All members have been screened to ensure there were no real or potential conflicts of interest.

Peer reviews are a standard procedure in science studies to ensure that sound, reliable scientific practices are applied and to provide confidence in the conclusions drawn from the studies.

TERA, an independent, non-profit corporation that has conducted over 50 independent peer reviews, has brought together eight risk assessment experts from across North America to provide a critical review of the Sudbury soils study. Their review of Volume 1 (Background) and Volume 2 (HHRA) is currently underway and expected to be completed in early 2007.

As part of the peer-review process, the panel members will attend technical meetings with the study team in Sudbury on September 20th and 21st. A public briefing hosted by TERA will be held on September 19. At the briefing, the community will have an opportunity to meet the experts and learn more about the peer-review process (see inset for more details).

TERA has appointed the following scientists to serve on the Independent Peer Review Panel for Volume 1 (Background) and Volume 2 (HHRA) of the study:

Dr. Michael Dourson

Ph.D. in Toxicology, University of Cincinnati; Diplomate of the American Board of Toxicology; President and Director, Toxicology Excellence for Risk Assessment (TERA), Cincinnati, OH

The author of more than 100 papers on risk assessment methods and co-author of numerous government risk assessment documents, Dr. Dourson specializes in assessing human health risks related to environmental contaminants, including chromium, arsenic, copper and nickel. Dr. Dourson spent 15 years with the US Environmental Protection Agency (EPA), winning four bronze medals for his work. In 2003, he was awarded the Society of Toxicology's Arnold J. Lehman award for major contributions that improve the scientific basis of risk assessment. Dr. Dourson has held officer positions in the American Board of Toxicology, the Society of Toxicology, and the Society for Risk Analysis.

Dr. Gary Diamond

BS Zoology, University of Maryland; Ph.D., Pharmacology, University of Minnesota; Senior Research Fellow, Environmental Science Center of SRC (Syracuse Research Corporation), Syracuse, NY

Dr. Diamond has more than 20 years of experience in human health risk assessment related to heavy metals. He has led numerous research projects to improve methods for assessing health risks from metal exposure. For five years, Dr. Diamond served as a consultant to the Metals Subcommittee of the Environmental Health Committee of the US EPA Science Advisory Board, and is a former faculty member of the Departments of Pharmacology and Environmental Medicine at the University of Rochester.

Dr. Andrew P. Gilman

BSc., Zoology, MSc. Toxicology, University of Western Ontario; PhD, Ontario Veterinary College, Department of Pathology President, Sustainable Solutions International, Ottawa, ON

Dr. Gilman has focused on metals-related research for over 25 years. He served as the Executive Director of the Office of Sustainable Development and Director of the Bureau of Chemical Hazards, Health Canada. He has developed regional and global programs to control the movement of substances through the environment, with a focus on metals such as mercury, lead, cadmium and uranium. Dr. Gilman has developed population health programs in various regions and has delivered guest lectures for the World Bank and the UN Environment Program. He received the Public Service of Canada's Award of Distinction in 2002 and the Queen's Golden Jubilee Award for community and public service in 2003.

Dr. D. Susan Griffin

PhD, Veterinary Toxicology and Pharmacology, University of California; Diplomate of the American Board of Toxicologists Senior Toxicologist, Superfund Program, US EPA, Denver, CO

Dr. Griffin has worked for the US EPA for 19 years and has extensive experience in assessing human health risks from mining and smelting sites in the Western states. She has studied how plants and animals take up arsenic and lead from soil.

Dr. Griffin has also worked with the US Agency for International Development (USAID) in Romania to help environmental agencies and citizen groups assess health risks from lead exposures at smelter sites. In 2000, she consulted with the government of Chile on arsenic exposures and health effects at a Chilean mine.

Dr. Heather E. Jamieson

BSc, Geology, University of Toronto; PhD, Geology, Queen's University; Faculty, Geological Sciences and Geological Engineering, and School of Environmental Studies, Queen's University, Kingston, ON

Dr. Jamieson's expertise is in understanding how metals are released from mine waste and impacted soils. The emphasis of her research is on the different forms or *species* of metals and their effects on human health. Dr. Jamieson uses advanced techniques such as synchrotron-generated X-ray to analyze soils and mine tailings. She is a Research Director of the GeoEngineering Centre at Queen's-RMC. Dr. Jamieson spent her first 17 years in Noranda, Quebec, where her father was a mine manager.

Dr. Charles Anthony Pittinger

MSc, Aquatic Ecology, University of Tennessee; Ph.D., Environmental Toxicology, Virginia Tech; Senior Toxicologist, BBL Sciences, Cincinnati, OH

Dr. Pittinger has extensive experience leading initiatives across the public and private sectors to implement sound science and regulatory policy. He joined the US EPA's Science Advisory Board for two terms, and has served on the Organization for Economic Co-operation and Development's (OECD) Risk Assessment Advisory Board, as well as the American Chemistry Council's Ecological Risk Assessment Steering Team. Dr. Pittinger has over 25 years of technical experience that includes environmental and human health risk assessment, industrial emissions, environmental chemistry, toxicology and impacts to sediment.

Dr. Rosalind A. Schoof

PhD, Toxicology, University of Cincinnati; Diplomate of the American Board of Toxicology; Principal, Integral Consulting, Inc., Mercer Island, WA

Dr. Schoof's research has focused on cancer and non-cancer related health risk assessments, with emphasis on chemical exposure from mining and mineral processing sites, manufacturing sites, landfills and incinerators. Dr. Schoof is particularly interested in the effects of human exposure to arsenic and metals from soils and diet. She has served on numerous peer review panels in the US and Canada, and has been a member of several US National Research Council committees. She is a member of the British Columbia Contaminated Sites Science Advisory Board and the Expert Advisory Panel for the Canadian Metals in the Human Environment Research Network.

Dr. Joyce Tsuji

BSc, Biological Sciences, Stanford University; PhD, Department of Zoology, University of Washington; Diplomate of the American Board of Toxicology; Principal, Exponent, Bellevue, WA

Dr. Tsuji is a toxicologist with 19 years of experience in risk assessment on projects in the US, Canada, South America, Africa, Australia, and Asia. She has worked on projects for the US EPA, the US Department of Justice, the Australian EPA, and state and local municipalities. Dr. Tsuji has conducted risk assessments of mining and smelting sites and has directed exposure studies involving health education, environmental sampling and monitoring of populations potentially exposed to metals in soil, water, and the food chain. She has served on a number of US National Academy of Sciences and US National Research Council subcommittees.

For more information on TERA peer reviews, visit their website at www.tera.org/peer.

Mark Your CALENDAR!

Public Briefing: Independent Expert Review Panel (IERP)

September 19, 2006 | 7:30 to 8:30 pm | Collège Boréal

Find out more about the peer-review process for the Sudbury Soils Study HHRA. Plan to attend this informative public briefing, hosted by TERA (Toxicology Excellence for Risk Assessment) and open to members of the community. For more information, go to www.sudburysoilsstudy.com or call toll-free 1-866-315-0228.

Ask an Expert!

Risk Assessments Explained

Dr. Ron Brecher, PhD, CChem, *Diplomate of the American Board of Toxicology (DABT)*

We sat down with Dr. Ron Brecher, Principal of GlobalTox International Consultants Inc., to get an expert perspective on the risk assessment process.

Dr. Brecher has over 18 years of experience assessing the human health impacts of chemicals in the environment. An internationally recognized expert in human toxicology, he has served on numerous scientific advisory panels in Canada and the US. Dr. Brecher is a member of the Society of Toxicology of Canada, the American Society of Toxicology, and the Society for Risk Analysis, and is one of about 35 Canadians certified by the American Board of Toxicology. He is an adjunct professor at the University of Waterloo.

Dr. Brecher is not affiliated with the consultants performing the Sudbury study. He provides input to the Technical Committee as the Scientific Advisor for Human Health.

In this interview, Dr. Brecher provides some insight on human health risk assessments (HHRAs) and how they support sound decision-making.

SARA: What is the difference between a hazard and a risk?

Dr. Brecher: Hazards and risks are very different, but they are often confused. A hazard is a thing, such as a chemical, that can pose a risk under certain conditions. For example: if I have a health hazard in a sealed container, there's no risk. But once that container is open and people are exposed to it, then there may be a potential risk. Risk depends on exposure to a hazard. HHRAs look at hazards and exposure to determine risks.

SARA: What is the purpose of a Human Health Risk Assessment (HHRA)?

Dr. Brecher: In any study of substances in the environment, there are three key questions:

1. *What do we have here?*
2. *What does it mean?*
3. *What should we do about it?*

Soil, air and water sampling within the study area usually answers the first question. The purpose of an HHRA is to answer the second question: "what does it mean?"

So, first you do testing in the environment and gather data. The risk assessment is conducted to understand what the data means. Then, these findings are given to decision-makers, who answer the third question by deciding what action, if any, should be taken.

The third question is about risk management, and will be answered after the HHRA is completed.

SARA: What will the risk assessment tell us?

Dr. Brecher: Risk assessments tells us which chemicals might pose an increased risk, and under what conditions. They also can tell us what specific health effects could occur, and how large an increase in risk might exist. Risk assessments also tell us which chemicals do not pose an increased risk.

For chemicals that might pose an increased risk, the HHRA can tell us what the effects might be. In other words, could exposure lead to a skin condition, throat irritation, cancer or some other effect? Does a person need to be exposed every day for their whole lifetime, or is occasional exposure a concern? Do risks come from swallowing it, breathing it, or touching it? Is it a concern for just some people—children or pregnant women, for example—or for everybody?

SARA: How do you interpret a risk level?

Dr. Brecher: In interpreting risk, you have to look at the numbers. Is the risk increased by one in a million, or by more than that? Those numbers are important because they tell us how much a health risk might be increased, but they're not the whole story. For instance, a small increase in a cancer risk may be of more concern than a larger increase in a relatively minor effect like throat irritation.

HHRAs usually examine risks that are very small; much, much smaller than risks of heart attacks, strokes or car accidents, for example. In general, risk assessments are designed to over-estimate risk. Another way of saying this is that they are designed to be "conservative." If an HHRA shows there might be a risk under specific conditions, it is appropriate to find out whether those conditions are likely to occur before making decisions about risk management.

SARA: How are cancer risks calculated?

Dr. Brecher: In North America, we have a 25 to 30 percent estimated cancer risk. So, all things being equal, about one in four people will develop some form of cancer in their lifetime. That's 250,000 people in a million.

The Province of Ontario determined that the maximum increase in lifetime cancer risk (from one chemical) that is considered "acceptable" is one in a million. That means we don't want the cancer risk to increase by more than one cancer for every million people who are exposed to the substance every day over a lifetime.

In other words, in Ontario, lifetime exposure to a particular substance in the environment should not increase the overall cancer risk to more than 250,001 in a million.

SARA: How do we know that these standards are protective enough?

Dr. Brecher: Toxicity information is usually based on animal studies, but where there is human information, it is used. Because there's uncertainty about what animal results mean to people, scientists are extremely conservative when relying on animal studies. For example, we assume that people are 10 times more sensitive than the most sensitive animals, and that sensitive people are 10 times more sensitive than average people. Other adjustments are also made to account for the need to sometimes rely on animal data to predict human risks.

SARA: If the actual risk levels do not meet the standard set by the province, is that cause for alarm?

Dr. Brecher: It may be cause for concern, and further study may be needed, but it's not necessarily cause for alarm.

Provincial criteria (standards) are generic, meaning that they are applied everywhere in Ontario. But they don't take into account local conditions such as weather, human behaviour, background levels (conditions that naturally exist) and specific forms of chemicals in the environment. They shouldn't be used in isolation to determine whether there is a health risk in a certain study area.

However, when you see an elevated result, more work should be done to understand what it means in the context of the study.

Elevated results in a sample don't necessarily translate into increased risk. It's important to look at the whole picture, at all of the information about the risk, to come to conclusions that support good decision-making.

SARA: Does a risk assessment protect children and sensitive people?

Dr. Brecher: Yes. Risk assessments include sensitive groups and life stages, such as young children, seniors, or people who may be more susceptible to the expected health effects. By protecting the most sensitive people in the population, everyone else is also protected.

For more information on Dr. Ron Brecher, please visit the GlobalTox website at www.globaltox.com.

The Chemicals of Concern being studied in the Sudbury Soils Study are arsenic, cobalt, copper, lead, nickel and selenium. More information on these metals is available at www.sudburysoilsstudy.com.

Study Watchdog:
Franco Mariotti, Independent Process Observer

I believe in a process that will give us the best science available to deliver the best answers. My role is to make sure that they are choosing the best process. — **Franco Mariotti**

Since it began in 2002, the Sudbury Soils Study has been conducted under the watchful eye of Franco Mariotti, the Independent Process Observer (IPO).

The role of the IPO is to oversee the process used to conduct the study, and to make sure that it is always transparent to the community.

The IPO sits as an observing member of both the Technical Committee (TC) and the Public Advisory Committee (PAC). He attends meetings, regularly reviews the study process, and evaluates the public consultation aspects of the study.

A lifelong resident of Sudbury, Mariotti was raised in Copper Cliff's "Little Italy," and earned a degree in Biology from Laurentian University. Since 1981, he has held the position of staff scientist at Science North and is involved with numerous community groups and environmental organizations.

"My role is not to make judgments on scientific analysis or techniques," says Mariotti. "It's to make sure the process is open and transparent and that the results achieved are the best possible. For example, if the suggestion is made in a meeting that an additional study could be done, I'm there to make sure that the best interests of the citizens and of the environment come first in that decision."

Mariotti is impressed with the process that TC has used to reach decisions. "So far, the key decisions have been made not just by majority, but by true consensus."

Franco Mariotti's quarterly reports are available on the website: **www.sudbury soilsstudy.com**. "Anyone can feel free to contact me at any time," says Mariotti. "That's important." He can be reached at 705.522.3701 ex. 244.

Mr. Mariotti's comments as IPO are provided as an independent perspective and do not necessarily represent the views of Science North.

Where we are now?

Draft HHRA Report submitted to TC

Soil Collection	TC and PAC started	SARA Group conducts Risk Assessments			
MOE Report	Risk Assessments (HHRA and ERA)				
2001	2002	2003	2004	2005	2006

Where we are going?

TERA peer-review process	Completion of Risk Assessments	Risk Management Decisions	Remedial Action (Long-Term and Short-Term if required)
Risk Assessment		Risk Management	
2006		2007	2008

Projected dates are based on current information and may be subject to change.

Have your say contact us

Here's how:

- Attend the public sessions at TC and PAC meetings
- Attend workshops and open houses
- Call our toll-free project information number at **1.866.315.0228**
- Send an email with your comments to: **questions@sudburysoilsstudy.com**
- Send written comments by mail or fax to:

The SARA Group
512 Woolwich St., Suite 2
Guelph ON N1H 3X7
Fax: 519.763.1668

If you would like copies of previous newsletters, please contact us or visit www.sudburysoilsstudy.com

Further information and frequently asked questions can be found at the project website **www.sudburysoilsstudy.com.**

Upcoming Events

Public Briefing

- Tuesday, September 19, 7:30 to 8:30 pm

2006 Technical Committee Meetings

- Thursday, September 14
- Thursday, October 12
- Thursday, November 9
- Thursday, December 14

Public Advisory Committee Meetings

- Tuesday, September 19, 6:00 to 7:00 pm
- Tuesday, November 21

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