Public Briefing on the

Independent Expert Review Panel (IERP) for the Ecological Risk Assessment Sudbury Soils Study

March 5, 2007
7:30-8:30 PM
Collège Boréal

AGENDA

I. Welcome
   Dr. Stephen Monet, Sudbury Soils Study Technical Committee

II. Background and Overview of the Ecological Risk Assessment
   Dr. Christopher Wren, SARA Group

III. Overview of the Independent Expert Review Panel (IERP) Process
   Ms. Jacqueline Patterson, *TERA*

IV. Introduction of the IERP

V. Audience Questions on the IERP process

After this session, members of the Technical Committee will be available to answer questions on the Soils Study.

Toxicology Excellence for Risk Assessment (*TERA*)
www.tera.org

Contact: Jacqueline Patterson 513-521-7426, Patterson@tera.org

The Independent Expert Review Panel (IERP) Process

This Independent Expert Review Panel (IERP) and meeting have been organized by Toxicology Excellence for Risk Assessment (*TERA)*. *TERA* is an independent non-profit organization with a mission to protect public health through the best use of toxicity and exposure information in the development of human health risk assessments. *TERA* has organized and conducted peer review and consultation meetings for private and public parties since 1996 (see http://www.tera.org/peer for information about the program and reports from meetings).

TERA scientists are well-experienced in toxicology, risk assessment, and conducting peer reviews. *TERA* was selected by the Technical Committee to independently organize and conduct this expert panel review. *TERA* has experience in risk assessment and toxicity of metals and has performed this work for a variety of public and private clients. None of *TERA*'s previous work related to the Sudbury Soils Study, nor has *TERA* worked for Inco or Falconbridge.

TERA has conducted reviews and worked on projects involving some of the contaminants considered at the Sudbury site, including arsenic, nickel, copper, lead, cadmium, and selenium, for a variety of clients. These projects were supported by the U.S. EPA, Health Canada, the Metal Finishing Association of Southern California, the International Copper Association, the U.S. Bureau of Land Management, Elf AtoChem North America Inc., the U.S. National Institutes of Occupational Safety and Health, and a metal refiner in South Africa. For the Ontario MOE, Dr. Lynne Haber of *TERA* peer reviewed the Rodney Street risk assessment and has been asked by MOE to be a peer reviewer for a community risk assessment currently being prepared. Dr. Pittinger, the panel chair, is a Visiting Scientist with *TERA.* He has worked on projects related to human health and environmental toxicity of mineral products and metal substances and he and his employer, ARCADIS BBL, provide consulting services to many types of public and private clients, including mining companies and consortia. None of Dr. Pittinger's projects has been with Inco or Falconbridge and to best of his knowledge his employer has not worked directly with these companies.

Independent Expert Review Panel

Peer review is commonly used in the sciences to judge the scientific merit of a manuscript or document. The intent of a peer review is to have a group of external experts evaluate a document's conclusions and the scientific basis for those conclusions. The purpose of this peer review is to have a panel of experts carefully evaluate the science and conclusions of the ecological risk assessment. The Sudbury Soils Study and human health and ecological risk assessments have been undertaken to determine what human health or ecological risks are associated with metal and arsenic levels present in the Sudbury area, and if there are unacceptable risks. Based on the available information for Sudbury, the study will provide a measure of the risk

level from metals and arsenic in soils, and may determine site-specific soil guidelines for the Sudbury area.

TERA staff, with the assistance of Dr. Charles Pittinger, was solely responsible for the selection of the IERP. *TERA* followed the U.S. National Academy of Sciences (NAS) guidance on selection of panel members to create a panel with a broad and diverse range of knowledge, experience, and perspective, including diversity of scientific expertise and affiliation. *TERA* reviewed dozens of scientist's credentials and selected these panel members for their extensive knowledge and experience in their fields. *TERA* believes this group of experts is well equipped to conduct a thorough review of the materials and provide expert advice. The panel members serve as *individuals*, representing their own personal scientific opinions. They do not serve as representatives of their companies, agencies, funding organizations, or other entities with which they are associated. Their opinions should not be construed to represent the opinions of their employers or those with whom they are affiliated.

An essential part of panel selection is the identification and disclosure of conflicts of interest and biases. Prior to selecting the panelists, each candidate completed a questionnaire to identify activities, financial holdings, or affiliations that may pose a real or perceived conflict of interest or bias. The completed questionnaires were reviewed by *TERA* staff and discussed further with panel candidates as needed. (See http://www.tera.org/peer/COI.html for *TERA's* conflict of interest and bias policy and procedures for panelist selection).

TERA has determined that each panel member has no conflicts of interest and is able to objectively participate in this peer review. None of the panel members has a financial or other interest that would interfere with his or her abilities to carry out the duties in an objective fashion. None of the panel members is employed by Inco/CVRD, Falconbridge/Xstrata, the other companies or agencies represented on the Sudbury Soils Study Technical Committee, or the companies comprising the SARA Group. Nor do the panel members have financial interests in the two mining companies. None of the panel members was involved in the preparation of the Sudbury human health or ecological risk assessments.

The independent peer review panel includes six scientists who have expertise in the key disciplines and areas of concern. Each panelist is a well-respected scientist in his or her field. The panel members have expertise in ecological risk assessment; terrestrial and aquatic ecotoxicology; toxicology of metals and arsenic; bioavailability of metals in soils and water; biogeochemistry; environmental fate of metals; effects of metals on flora and fauna, including forest ecosystems; ecological processes; ecological modeling; landscape ecology, probabilistic risk assessment; and remote sensing.

Sudbury Ecological Risk Assessment Expert Panel

Joseph W. Gorsuch, M.S.
President
Gorsuch Environmental Management Services, Inc.
Webster, New York, USA

Samuel N. Luoma, Ph.D.
Senior Research Hydrologist
U.S. Geological Survey
Menlo Park, California, USA
Scientific Associate
The Natural History Museum
London, UK

Charles A. Pittinger, Ph.D.
Senior Toxicologist
ARCADIS/BBL
Cincinnati, Ohio, USA

William A. Stubblefield, Ph.D.
Senior Environmental Toxicologist
Parametrix, Inc.
Oregon State University (Courtesy Faculty)
Albany, Oregon, USA

Joyce S. Tsuji, Ph.D., DABT
Principal
Exponent
Bellevue, Washington, USA

Shaun Watmough, Ph.D.
Assistant Professor
Environmental Resource Science Program
Trent University
Peterborough, Ontario, Canada

Review Package and Charge to Peer Reviewers

The panel received the review package approximately seven weeks prior to the meeting to ensure adequate time to carefully review the documents and prepare for the meeting discussions. Materials sent included Volume I– Background, Study Organization and 2001 Soils Survey and Volume III – Ecological Risk Assessment. Review materials also included compact discs, including data and reports from the soil surveys, and appendices with key data and information. *TERA* developed a “charge to peer reviewers” document that outlined the key questions and scientific issues that need to be discussed by the panel in order to evaluate the quality and completeness of the risk assessment. The charge covers a number of comprehensive questions about quality

and scientific defensibility. In addition, there are several dozen more detailed questions that the panel will use to help guide their discussions and conclusions (see www.tera.org/peer/sudbury/sudburywelcome.htm for complete list of charge questions).

Questions for the Sudbury Soils Study
Ecological Risk Assessment Expert Panel

1. To what extent did the ERA achieve its two major goals:
    a. to characterize the current and future risks of COCs to terrestrial and aquatic ecosystem components; and
    b. to provide information to support activities related to the recovery of regionally-representative, self-sustaining ecosystems in areas affected by the COCs?
2. Have the key ecological objectives of the Sudbury Soils Study been addressed by this assessment?
3. Were the approaches used for this ecological risk assessment consistent with commonly accepted methods and sound scientific procedures?
4. Is the Ecological Risk Assessment presented clearly and completely?
5. Are the conclusions and recommendations supported by the available data?
6. Have the important uncertainties been identified and their impact on the characterization of risk and overall conclusions been fully discussed?
7. Are there additional important issues that should have been addressed?

Meeting Procedures

The meeting will be organized to make the best use of the time available to hear and discuss the opinions of the panelists regarding the charge questions and the ecological risk assessment. The meeting will begin with brief panel introductions and a discussion of any conflict of interest and bias issues. The discussion will then address the problem formulation, the work done for the three main objectives of the ERA, and the conclusions and recommendations. Before each discussion section, the authors of the assessment document will make a short presentation. These presentations will highlight the salient points and focus on important issues. There will be a brief time for panel member clarifying questions and then the panel will discuss the relevant charge questions. The panel recommendations and conclusions will be summarized in a meeting report.

Meeting Report

TERA will draft a meeting report that briefly summarizes the panel's discussions and recommendations. The meeting report will serve as a record of the peer review and will assist the authors in making revisions to the ecological risk assessment. The report will be reviewed by the panel members for accuracy before it is finalized.

Biographical Sketches of the Sudbury Soils Study Ecological Risk Assessment Independent Expert Review Panel (IERP)

Joseph W. Gorsuch

Mr. Gorsuch is President and owner of Gorsuch Environmental Management Services, Inc (G.E.M.S., Inc). Prior to developing G.E.M.S., Inc., he worked 30 years for the Eastman Kodak Company before retiring in 2004. Mr. Gorsuch has a B.S. in Wildlife Biology and an M.S. in Environmental Sciences, with both degrees from Purdue University. Through his work at Purdue University and Kodak, and with professional societies and trade group committees, Joe has over 35 years of experience with soils toxicity testing. He has served on numerous professional, government and trade group committees, task groups, and review panels regarding plant testing and toxicology, environmental effects and fate of silver, ecological risk assessment, and metals in soils. He was a presenter and co-facilitator at several U.S. EPA Workshops on Environmental and Plant Toxicology, and Genetic Engineered Plant Topics, and a peer reviewer of extensive EPA plant studies in 2006, including native vegetation. In 1993, as a plant toxicity expert, he was an invited participant in the Environment Canada CAPP Workshop "Tests to Evaluate Natural Gas Well Remediation Sites" in Calgary, Alberta. Since 2000, he has been a member of the Environment Canada Science Advisory Group for Plant Tests. In 2005, he was an invited participant of the Natural Resources Canada International Workshop "Metals in Soils: Science Gaps and Regulatory Needs" in Ottawa, Ontario. Mr. Gorsuch's continuous dedication and involvement with the Society of Environmental Toxicology & Chemistry (SETAC) since 1980, led him to be the recipient of the "Herb Ward Exceptional Service Award" in 2003. He has been a member of the American Society of Testing and Materials (ASTM), Committee E47 Environmental Effects and Fate, since 1980, receiving two awards, including the ASTM Committee E47's highest award. Mr. Gorsuch serves on four scientific journal editorial boards, has authored and co-authored approximately 40 scientific peer-reviewed publications, has helped organize and facilitate over 10 symposia on plant and soil testing, and has served as editor on six books (three on using plants in toxicity tests) and five special journal publications (including risk assessment of metals in soil).

Mr. Gorsuch was selected for the ERA panel for his experience and expertise with soils, earthworm and plant toxicity testing; effects of metals on flora and fauna; ecological risk assessment; and, remote sensing.

Dr. Samuel N. Luoma

Dr. Luoma is a Senior Research Hydrologist with the US Geological Survey (USGS). He has been with USGS since 1975. Dr. Luoma served as the first Lead Scientist for the CALFED Bay-Delta program between August 2000 and November 2003. He received his Ph.D. in Zoology from the University of Hawaii. His research interests are in the fate and effects of contaminants, primarily metals and metalloids, in aquatic ecosystems. He has worked on contaminant bioavailability to invertebrates from diet and water, biomonitoring, sediment contamination, processes affecting metal fate and form, and both organism-level and community-level effects of metals. He has additional interests the linkages between science and policy, and communication of environmental risks, especially in the arena of water management. He has advised and contributed in a number of different forums on the implications of various advances in metals science to managing those contaminants in the environment. Advisory functions have included the Canadian NRC Committee on Biologically Available Metals in Sediments (1988); the Ad Hoc, 4 person committee that designed USGS National Water Quality Assessment; National Science & Engineering Research Council, Canada, Strategic Grant Selection Panel for Environmental Quality; U.S. EPA Science Advisory Board Subcommittees on Sediment Quality Criteria; and, the U.S. EPA SAB panel reviewing the Metal Framework. He chaired the Science Advisory Group for the Interagency Ecological Program, San Francisco Bay/Delta and was Chair of the Science Advisory Committee, for Water Resources Division USGS Senior Staff. He was on the Science Advisory Committee for the U.S. EPA Center of Excellence (Center for Environmental Health Research), UC Davis. He participated in a series of four Society of Environmental Toxicology and Chemistry (SETAC) and U.S. EPA Workshops on Re-evaluation of the State the Science for Water Quality Criteria development and hazard assessment for metals. In 2002-03 he was on the National Academy of Sciences, NRC committee on Bioavailability of Contaminants from Soils and Sediments. Dr. Luoma has received several awards and commendations, including the Distinguished Government Service Award from SETAC and in 2004 he was named a Fulbright Distinguished Scholar and served in London at the Natural History Museum. He is currently working on a book on managing metal contamination in aquatic environments as a follow-up to that appointment. Sources of funding include City of Palo Alto for San Francisco Bay monitoring, State of California (CALFED Bay-Delta Program) for work with selenium and mercury, US EPA Superfund Program for work monitoring the Clark Fork River in Montana, US EPA Region 9 for work on evaluating alternative site-specific criteria for selenium in California, and the US Department of Defense to study ecosystem recovery after *in situ* remediation of PCB sediment contamination. Dr. Luoma has published approximately 140 peer-reviewed articles, authored a dozen book chapters, and co-authored two books.

Dr. Luoma was selected for the ERA expert panel for his expertise and experience in ecological risk assessment, bioavailability of trace metals in soils, environmental fate of metals, effects of metals on fauna and ecological processes.

Dr. Charles A. Pittinger

Dr. Pittinger is a Senior Toxicologist with ARCADIS BBL in their Global Product Stewardship Practice. He is also a Visiting Scientist with Toxicology Excellence for Risk Assessment (*TERA*). He worked for seventeen years as Principal Scientist for The Procter & Gamble Company, during which he conducted basic and applied research and risk assessments of consumer product ingredients, and developed regulatory submissions for federal and international authorities. Dr. Pittinger has over twenty-five years of experience in toxicology, environmental risk assessment methodologies, and aquatic and terrestrial ecotoxicology. He received his Master's in Aquatic Ecology from The University of Tennessee, and his Ph.D. in Environmental Toxicology from Virginia Tech. His experience ranges from environmental and human health risk assessment and management of consumer product ingredients and industrial emissions; physicochemical property estimation by quantitative structure-activity relationships; environmental fate and transport modeling; technical external relations; environmental chemistry; toxicology; and sediment contamination.

Dr. Pittinger served two terms on the U.S. EPA's Science Advisory Board, Ecological Processes, and Effects Committee (EPEC). He participated as a panelist in numerous other peer reviews and technical advisories, including the EPA's Southeastern Ecological Framework and the Index of Watershed Indicators. He also helped to champion the establishment of SETAC's (Society of Environmental Toxicology and Chemistry) Peer Review Program and led the first SETAC peer review of the American Chemical Council's Long-Range Research Initiative. He also chaired the American Industrial Health Council's Ecological Risk Assessment Committee for five years, and he served on the OECD's Risk Assessment Advisory Board, the American Chemistry Council's Ecological Risk Assessment Steering Team, and ASTM Subcommittee E-47. Dr. Pittinger has published more than forty technical articles, book chapters, and editorials. He has convened and chaired numerous technical steering committees and peer reviews for the public and private sectors.

Dr. Pittinger was selected by *TERA* to be the Chair of the ERA IERP based on his experience and knowledge of ecological risk assessment and experience in chairing scientific workshops and panels. His expertise includes ecological risk assessment, and bioavailability, toxicity and environmental fate of metals.

Dr. William A. Stubblefield

Dr. Stubblefield is a senior environmental toxicologist with Parametrix, Inc., and serves as a courtesy faculty member at Oregon State University, Department of Molecular and Environmental Toxicology. He has more than 20 years of experience in environmental toxicology, ecological risk assessment, water quality criteria derivation, and aquatic and wildlife toxicology studies. Dr. Stubblefield received his Ph.D. in Aquatic Toxicology from the University of Wyoming and his M.S. in Toxicology/Toxicodynamics from the University of Kentucky. Dr. Stubblefield served as President of the Society of Environmental Toxicology and Chemistry (SETAC) and chaired several SETAC committees. He has served on numerous committees and panels for the U.S. EPA, including the Science Advisory Board's Framework for Inorganic Metals Risk Assessment Review Panel; and the Multimedia, Multipathway, and Multireceptor Risk Assessment Model System Panel. He recently chaired an independent-review panel that looked at issues associated with liquid waste management in the Capital Regional District (Victoria, BC). Dr. Stubblefield has authored more than 100 peer-reviewed publications and technical presentations in aquatic and wildlife toxicology and environmental risk assessment. He is a co-editor of a recently published book, *Re-evaluation of the State of the Science for Water Quality Criteria*, which examines the issues and approaches to be used in the evaluation of environmental impacts associated with contaminants.

Dr. Stubblefield was selected for the ERA panel for his expertise in bioavailability of trace metals in soils, environmental fate of metals, effects of metals on flora and fauna, and ecological risk assessment.

Dr. Joyce S. Tsuji

Dr. Tsuji is a Principal in Exponent's Health Sciences practice and is located in the firm's Bellevue, Washington office. Dr. Tsuji received a B.S. in biological sciences from Stanford University with honors and distinction, Phi Beta Kappa, and a Ph.D. focused in physiology and ecology from the Department of Zoology, University of Washington. She is a Diplomate of the American Board of Toxicology and has 19 years of experience in toxicology and risk assessment on projects in the United States, Canada, South America, Africa, Australia, and Asia for industry, as well as for the U.S. EPA, the U.S. Department of Justice, the Australian EPA, and state and local municipalities and agencies. Particular areas of interest include exposure assessment and toxicology of a variety of chemicals including those from industrial releases and in consumer products and nanomaterials. Dr. Tsuji has specialized experience with mining and smelting sites and the toxicology, bioavailability, and exposure to metals such as arsenic, lead, cadmium, mercury, manganese, chromium, and zinc. She has conducted and reviewed human health and ecological risk assessments of mining and smelting sites, and has designed and directed exposure studies involving health education, environmental sampling, and biomonitoring of populations potentially exposed to metals in soil, water, and the food chain. Dr. Tsuji has served on expert committees for the National Research Council, including serving as a peer reviewer for the report on the Coeur d'Alene Basin mining site and risk assessment. She has also served on committees for the U.S. EPA, U.S. Army, and the State of Washington (including the Area Wide Soil Contamination group of experts convened by the State of Washington to evaluate arsenic and lead in soil). Dr. Tsuji has served as an expert witness on several legal cases involving metals and mines and has published a number of papers on risk assessment issues, including arsenic and lead in soils.

In addition to human health studies, Dr. Tsuji has also directed and conducted studies assessing the ecological effects of chemicals in the environment, many involving mining and smelting sites. These studies have evaluated the ecological effects of metals and other chemicals in soil, water, and sediments as well as their bioavailability and transfer via the food web. As noted above, she has a strong background from her doctoral studies in ecology and physiology and her published research involved fieldwork in Washington, California, Colorado, and Costa Rica. Dr. Tsuji served on the HHRA IERP and has been selected for the ERA panel to provide scientific linkage between the panels, as there are a number of scientific issues that overlap.

Dr. Shaun A. Watmough

Dr. Watmough is an Assistant Professor in the Environmental Resource Science Program of Trent University. His research focuses on ecosystems and environmental stress, and his research interests include forest ecology, plant stress, biogeochemistry, forestry, air pollution, climate change, trace metals, eutrophication, and environmental modeling. Dr. Watmough received his Ph.D. in Plant Stress Physiology from Liverpool John Moores University (UK) and his B.Sc. in Applied Biology from Liverpool Polytechnic (UK). His Ph.D. research assessed the impacts of metals to long-lived plant species. Dr. Watmough has received research support from Trent University and a number of government and other sources, including the Canada Foundation for Innovation, National Sciences and Engineering Research Council of Canada, Canadian Wildlife Service, Canada Foundation for Innovation, Ontario Ministry of the Environment (MOE), Canadian Council Ministers on Environment, Cumulative Environmental Management Association, Environment Canada, Ontario Power Generation, Metals in the Environment (MITE) Research Network, North Eastern Research Cooperative, and the Canadian Forest Service. His funding from MITE has been used in the past to study metal biogeochemistry in forested ecosystems. The MITE Research Network is a collaboration of academia, government, and industry; funding is administered through Guelph University. He has over 50 peer-reviewed publications, including more than 15 that study metal cycling and impacts in the natural environment. He serves as a manuscript referee for numerous journals.

Dr. Watmough was selected for the ERA expert panel for his expertise in the impacts of metals on soils and vegetation, vegetation response to metals, ecology and ecological modeling, and metal biogeochemistry.