Appendix B

Summary of Committees and Activities

Representatives for Technical Committee:

Affiliation or Role	Representative
Chair	Dick DeStefano
Independent Process Observer	Franco Mariotti
Inco/CVRD Inco/Vale Inco	Glen Watson
	Dr. Bruce Conard
	Dr. Mike Dutton
	Dr. R. W. Francis (former)
Falconbridge Nickel/ Xstrata Nickel	Marc Butler
	Dr. Gord Hall
	Denis Kemp
Ministry of the Environment	Minnie de Jong
	Brian Cameron
	Dale Henry
	Dr. Brendan Birmingham
	Brian McMahon (former)
	Mary Ellen Starodub (former)
City of Greater Sudbury	Bill Lautenbach
	Dr. Stephen Monet
Sudbury & District Health Unit	Ido Vettoretti
	Bruce Fortin
	Dr. Penny Sutcliffe
Health Canada	Ray Alatola
Unions Observers	Kevin Boyd (United Steel Workers of America)
	Peter Soal (United Steel Workers of America)
	Rick Grylls (Canadian Auto Workers)
Administrative Support	Julie Sabourin

Representatives for Communications Sub-Committee (CSC):'

Company	Representative	Role
Vale Inco	Cory McPhee	Manager, Public and Government Affairs (2002–present)
	Angie Robson	Manager, External Relations (2007-present)
Xstrata Nickel	Dale Coffin	Director, Communications and Public Affairs (2002–2004)
	Ian Hamilton	(2004–present)
City of Greater Sudbury	Nicole Charette	Manager of Corporate Communications and French Language Services (2002–2004)
	Ghislain Lamothe	Manager of Corporate Communications and French Language Services (2004–present)
Sudbury& District Health Unit	Sandy Siren	Manager, Communications (2002–present)
Ministry of the Environment	Suzanne Arsenault	Regional Communications Advisor (2003–2005) (2008 to present)
	Lyne Demers	Regional Communications Advisor (2006 to 2008)

Representatives for Public Advisory Committee (PAC):

Name	From	To
Ersin Abdullah	Mar. 16/04	present
Darrel Alston (FN)	Feb. 18/03	present
Norris Artuso	Feb. 25/02	Nov.19/02
Nicole Breau	Apr. 14/05	present
Adam Cecchetto	Mar 27/07	present
Irma Chiesa	June 22/04	Mar 10/05
Joe Cimino	Feb. 25/02	May 17/05
Dick Cowan	Apr. 14/05	present
Kim Edgington	June 22/04	Mar 10/05
Ivan Filion *(former Chair)*	Feb 25/02	June 22/04
Ronda Gougeon	Nov. 19/02	Sept. 16/03
John Hogenbirk *(Chair)*	Feb. 25/02	present
Gary Hrytsak *(Vice-chair)*	Feb. 25/02	present
Nancy Keller	Feb. 25/02	June 18/03
Aino Laamanen	Sept. 17/02	present
Dino Maserio	Nov. 19/02	Mar. 16/04
Larry McGregor (FN)	Feb. 25/02	Feb 18/03
Lesley Nebenionquit (FN)	May 18/04	(to substitute for Rubina)
Rubina Nebenionquit (FN)	Feb. 25/02	Jan. 16/07
Steve Reitzel	Feb 25/02	July 16/02
Paul St. Jean	Sept. 17/02	Sept. 21/04
Jennifer Santarre	Feb. 25/02	April 25/03
Bob Somek	Mar. 16/04	present
Paula Takats	Mar 27/07	present
Carmen Wabagejik	Nov. 18/03	(to substitute for Rubina)
Carol Zippel	Mar. 16/04	present

*Each member was elected for a two-year term, with the possibility of extension.

FN – First Nations representative

Table B.1 Technical Committee (TC) Meetings for the Sudbury Soils Study

2005	2006	2007	2008
Dec 5/05	Dec 14/06	Nov 15/07	Feb 14/08
Sept 8/05	Oct 12/06	Oct 18/07	
Aug 11/05	Aug 10/06	Aug 16/07	
June 9/05	June 8/06	Feb 8/07	
May 12/05	May 11/06		
Apr 14/05	Apr 13/06		
Mar 10/05	Feb 9/06		
Feb 10/05			
Jan 13/05			
2001	**2002**	**2003**	**2004**
Dec 10/01	Dec 9/02	Dec 11/03	Dec 9/04
Nov 14/01	Nov 12/02	Nov 6/03	Oct 14/04
Oct 17/01	Oct 15/02	Oct 2/03	Sept 9/04
Sept 27/01	Sept 9/02	Sept 3/03	Aug 12/04
	Aug 27/02	Aug 12/03	July 8/04
	July 8/02	July 15/03	June 10/04
	June 10/02	June 3/03	May 13/04
	May 22/02	May 6/03	Mar 11/04
	Apr 8/02	Apr 8/03	Feb 11/04
	Mar 12/02	Mar 18/03	
	Feb 11/02	Feb 10/03	
	Jan 14/02	Jan 10/03	

Table B.2 Public Advisory Committee (PAC) Meetings for the Sudbury Soils Study

2005	2006	2007
Jan 17/05	Nov 21/06	Sept 27/07
Nov 15/05	Sept 19/06	May 15/07
Sept 20/05	May 16/06	Mar 27/07
June 21/05	March 21/06	Jan 16/07
May 17/05		
Apr 14/05		
March 19/05		
Jan 19/05		
2002	**2003**	**2004**
Nov 17/02	Nov 18/03	Nov 9/04
Sept 17/02	Sept 16/03	Sept 16/04
July 16/02	May 20/03	June 22/04
June 18/02	Feb 18/03	May 18/04
Apr 16/02		Mar 16/04
Apr 2/02		Jan 20/04
Feb 25/02		

Table B.3 Communication Sub-Committee (CSC) Meetings for the Sudbury Soils Study

2006	2007	2008
Nov 6/06	Dec 14/07	Jan 4/08
Aug 8/06	Dec 10/07	
June 14/06	Nov 16/07	
Mar 2/06	Nov 1/07	
Jan 13/06	Oct 19/07	
	Oct 2/07	
	Sept 18/07	
	Aug 21/07	
	July 26/07	
	July 6/07	
	June 20/07	
	Feb 5/07	
	Jan 26/07	
	Jan 18/07	
2003	**2004**	**2005**
Dec 10/03	Dec 17/04	Aug 8/05
Nov 5/03	Dec 8/04	May 31/05
Oct 10/03	Oct 13/04	July 21/05
Oct 1/03	Sept 8/04	June 16/05
Sept 19/03	Aug 11/04	June 1/05
Sept 4/03	July 6/04	
Aug 14/03	June 24/04	
Aug 11/03	June 9/04	
Jul 16/03	May 27/04	
Jun 20/03	May 19/04	
Jun 4/03	Mar 11/04	
May 9/03	Feb 25/04	
May 7/03	Feb21/04	
Mar 19/03	Feb 11/04	
Jan 14/03		

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
Nov 28/07	Interview with Franco Mariotti, Independent Process Observer	CBC Radio
Nov 28/07	Interview with Omer Sequin	CBC Radio
Nov 27/07	Interview with Dr. Christopher Wren, SARA Group	CBC Radio
Sept 26/07	Soil Study doubles in cost and Scope	Sudbury Star
Sept 26/07	Interview with Dr. Christopher Wren, SARA Group	CBC Radio
Aug 14/07	Word continues on soils study's risk assessment portion	Sudbury Star
May 4/07	Sudbury Soils Study	CBC Radio
Mar 13/07	Soil Study report delayed to fall	Sudbury Star
Mar 6/07	Scientists examine soils study findings	Sudbury Star
Mar 5/07	Soils Study presentation set for tonight	Sudbury Star
Sept 22/06	Soils study received Independent Peer Review	News release
July 8/06	Sudbury soil study progressing	Sudbury Star
July 4/06	Soils study beginning International Peer Review	News release
June 7/06	Sudbury soils study - delayed	Sudbury Star
Jun 1/05	Examining the Impacts of a Century of Mining	Sudbury Mining Solutions
May 27/05	Assessing the risks	Sudbury Star
May 12/05	More support needed to deal with arsenic (letter from Grylls)	Sudbury Star
May 6/05	Falconbridge residents not at risk: study shows arsenic levels normal	Northern Life
May 6/05	Arsenic level lower than most, study finds	Sudbury Star
May 6/05	Study: Arsenic levels in Falconbridge residents is normal. Not all residents are convinced of report's findings	SudburyNewsNow.com
May 5/05	Report on arsenic levels in soil	CBC Morning North
May 5/05	Soils Study	CBC Radio French
May 5/05	Falconbridge residents' arsenic exposure similar to comparison community	news release
May 4/05	Arsenic exposure study underway in Falconbridge	CBC Radio
Apr 19/05	Sudbury Soils Study nearing completion	Sudbury Star
Apr 5/05	Review panel organizers tour Sudbury	news release

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
Feb 10/05	Soils Study takes next step	Sudbury Star
Feb 8/05	Community information session at Science North, February 9, 2005	news release
Jan 20/05	Soils Study updates committees on recent progress	news release
Jan 20/05	Union legend in hospital	Sudbury Star
Jan 19/05	Air quality of city within guidelines, report finds	Sudbury Star
Nov 24/04	Soils study group needs volunteers	
Nov 19 and 20/04	Water: Looking at our liquid assets (ad requesting volunteers for residential well sampling)	Northern Life and Sudbury Star
Nov 19/04	Forward thinking: Reaching milestones in Sudbury	ad placed in EarthCare supplement, Northern Life
Nov 17/04	Soils study asking for volunteers for residential well sampling program	news release
Oct 15/04	Inco has concerns about study analysis	Northern Life
Sept 14/04	Environment Minister shows support for the Sudbury Soils Study	news release
Sept 2/04	Arsenic exposure study underway in Falconbridge	news release
Aug 25/04	Study asks: Where did all the frogs go?	Sudbury Star
Aug 25/04	Science meets tradition at Whitefish Lake First Nation	Sudbury Star
Aug 13/04	SARA Group starts summer field collection program	news release
July 26/04	Soils study: no immediate cause for concern	Sudbury Star
July 21/04	Sudbury Soils Study Technical Committee releases 2001 Sudbury Soils Data Report	news release
July 17/04	Arsenic study on schedule	Sudbury Star
June 24/04	"It's not a con job; it's not a lie"	Sudbury Star
June 11/04	SARA Group releases results of 2003 Vegetable Garden Survey	news release
May 22/04	Soils study to examine city's drinking water	Sudbury Star
19/05/2004	Soils study considering taking indoor air samples to determine nickel levels	Sudbury Star
May 14/04	Soils study to look at water, food this summer	news release
05/05/2004	That Sudbury is built on slag may be worrisome - Letter to the Editor by Alvin Smith	Sudbury Star
28/04/2004	Public trust a vital part of Sudbury Soils Study	In Contact (Inco employee magazine)
April 27/04	Vegetable gardens are safe: study	Sudbury Star
April 14/04	Soils study group to release Vegetable Garden Data	news release
31/03/2004	Air quality monitoring below provincial guidelines (interview with Wren)	CBC Radio
31/03/2004	Group studying arsenic contamination	Northern Life

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
27/03/2004	Arsenic in soil likely not a health risk, research says	Sudbury Star
25/03/2004	Falconbridge arsenic visits (interview with Pinsent)	CICI TV
26/03/2004	Falconbridge arsenic visits (interview with Smith)	Channel 10 News
26/03/2004	Falconbridge arsenic visits	Radio Canada
25/03/2004	Falconbridge arsenic visits (interview with Smith and Pinsent)	MCTV
25/03/2004	Falconbridge arsenic visits (interview with Wren)	CKAP-AM (Kapuskasing)
25/03/2004	Falconbridge arsenic visits (interview with Smith and Pinsent)	CBC Radio
25/03/2004	Falconbridge arsenic visits (interview with Smith and Pinsent)	CICI TV
25/03/2004	Falconbridge arsenic visits (interview with Smith and Pinsent)	Channel 10 News
25/03/2004	Study team members go door to door	Sudbury Star
25/03/2004	Falconbridge arsenic study (interview with Wren)	CIGM-AM Radio
24/03/2004	Falconbridge arsenic study (interview with Wren)	CBC Radio
24/03/2004	Falconbridge arsenic study (interview with Wren)	CIGM-AM Radio
March 24/04	Falconbridge residents participate in study to begin this week	SARA News Release
22/03/2004	Ramsey's water focus of study	Sudbury Star
18/03/2004	Falconbridge real estate	Channel 10 News
17/03/2004	Soils study group wants firm answers	Sudbury Star
17/03/2004	Physicians Packages (interview with Peddle)	Channel 10 News
17/03/2004	Sudbury Soils Study (interview with Filion)	MCTV
16/03/2004	Soil study on schedule (interview with Peddle)	Northern Life
13/03/2004	Sudbury Soils Study could be delayed	Sudbury Star
12/03/2004	Water not tested for nickel	Sudbury Star
12/03/2004	Water not tested for nickel - Woman wants the Sudbury Soils Study to look into it	Mines and Communities Website http://www.minesandcommunities.org/Action/press293.htm
12/03/2004	Soils study communications expand to physicians	SARA News Release
12/03/2004	Nouvelles communications sur l'étude des sols à l'intention des médecins	SARA News Release
08/03/2004	Unions belong on committee: group	Sudbury Star
01/03/2004	Sudbury soil study assesses risk from elevated metal levels	Sudbury Mining Solutions Journal
20/02/2004	Home-grown goods ok tests show	Northern Life
13/02/2004	Air monitoring shows metal levels well below provincial criteria	SARA News Release
25/01/2004	Soil study group opens process to residents	Northern Life
22/01/2004	Scientific advisor promises committee independence	The Sudbury Star
20/01/2004	Get involved with Falconbridge soils study, public urged	The Sudbury Star
08/01/2004	Soil study group addresses residents concerns	Northern Life
18/12/2003	Soils study looks to expand	The Sudbury Star

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
12/12/2003	Sara Group focuses on consulting with the community	SARA News Release
12/12/2003	Soil Study just the beginning of the healing	The Sudbury Star
08/12/2003	Falconbridge residents to be tested	The Sudbury Star
02/12/2003	Soils study testing continues to try and answer key questions	Northern Life
26/11/2003	Soils study gets shot in arm	The Sudbury Star
25/11/2003	Sudbury soils study - open house at Science North, November 25, 2003	SARA News Release
24/11/2003	Officials hope for good turnout for soils meeting	The Sudbury Star
20/11/2003	Not looking for work : Lawyer	The Sudbury Star
19/11/2003	Certains sols ont 100 fois plus de nickel que la norme	Voyageur
18/11/2003	Public Open House Announcement	Northern Life
07/11/2003	EarthCare Sudbury 2003 (newspaper supplement)	Northern Life
06/11/2003	Open house preparations underway	SARA News Release
06/11/2003	La préparation de la journée portes ouvertes est en cours	SARA News Release
05/11/2003	Volunteer Members Wanted	Northern Life
00/11/2003	Community based risk assessment for the Sudbury smelters - the Sudbury soils study	Ontario Mining Association Environmental Report
18/10/2003	Soils study must be independent of both Inco and Falconbridge (letter)	The Sudbury Star
09/10/2003	Unions' attack on soils study justified (letter)	The Sudbury Star
04/10/2003	Sudbury soils study is long overdue, and welcome (letter)	The Sudbury Star
04/10/2003	Soils study to test for metal levels, types	The Sudbury Star
03/10/2003	Soil and vegetable sampling now complete	SARA News Release
27/09/2003	Soils study takes to the air	The Sudbury Star
25/09/2003	Sudbury soils study set to launch air monitoring program	SARA News Release
19/09/2003	Safety activist protests role of Inco, Falco in soil study	Northern Life
19/09/2003	Taking an Environmental Approach (Falconbridge 75th anniversary supplement)	Northern Life
18/09/2003	Soils study blasted for not being 'friendly to public'	The Sudbury Star
18/09/2003	Protect the soil study (editorial)	The Sudbury Star
17/09/2003	Sudbury Soils Study (interview with McPhee and Gilespie)	Channel 10 News
17/09/2003	PAC Meeting Coverage (interview with Filion) (2)	Radio Canada
17/09/2003	PAC Meeting Coverage (interview with Filion) (1)	Radio Canada
17/09/2003	PAC meeting coverage (Interview with Seguin)	Radio Canada
16/09/2003	Unions want Inco, Falco off committee	The Sudbury Star
16/09/2003	Study set to confirm or allay 100 years of suspicions	The Sudbury Star
11/09/2003	Falco Ltd offers to pay for health tests	The Sudbury Star
03/09/2003	Les chercheurs se défendant de faire une étude bidon	Le Voyageur

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
13/08/2003	Comments 'surprise' group	The Sudbury Star
10/08/2003	Les chercheurs surveilleront aussi la qualité de l'eau et de l'air	Le Voyageur
07/08/2003	Lawyer for residents suing Inco visit city	The Sudbury Star
26/07/2003	Corporate responsibility (editorial)	The Sudbury Star
26/07/2003	Lawyers take interest in Sudbury Soils Study: Law firm represents Port Colborne residents who are suing Inco over contaminated soil	The Sudbury Star
23/07/2003	Gardens being studied for contamination	Northern Life
23/06/2003	Analysis is fair, balanced and, above all, necessary: Sudburians should embrace the process (Opinion - Mariotti)	The Sudbury Star
20/06/2003	Medical officer not worried about arsenic levels	Northern Life
20/06/2003	Amazing plants 'grow' nickel	Northern Life
18/06/2003	Des citoyens réclament qu'Inco et Falconbridge se retirent du Comité	Le Voyageur
16/06/2003	Inco Strike (interview with Pearson and Seguin)	CBC Radio
13/06/2003	Soil study (interview with McMahon)	CBC Radio
13/06/2003	Activists want Inco, Falco off the Sudbury soils study committee	Northern Life
12/06/2003	Soil study…soiled? (Interview with Desmarais)	CBC Radio
12/06/2003	Soil study (interview with McMahon and Seguin)	CBC Radio
12/06/2003	Soil study (interview with Desmarais, Wiggins and Filion)	Radio Canada
12/06/2003	Soil study (interview with Pearson, Mariotti and Seguin)	CBC Radio
12/06/2003	Two from Port in Sudbury to discuss soil contamination	Port Colborne Tribune
12/06/2003	Activists fear contamination may be skewed by Inco and Falconbridge	The Sudbury Star
12/06/2003	Soils meeting erupts into nasty free-for-all	The Sudbury Star
12/06/2003	Inco news conference gets loud	The Sudbury Star
11/06/2003	Soil study	CBC Radio
11/06/2003	Soil study	CBC Radio
11/06/2003	Soil study (interview with Pearson and Seguin)	CICI TV
10/06/2003	Shelley Martel Report in House of Commons	
09/06/2003	Open house at Science North, June 11, 2003	SARA News Release
05/06/2003	Residents blame Inco for toxic homes	CBC Radio
04/06/2003	Un nouveau procédé minier pour réhabiliter les sols contaminés	Le Voyageur
04/06/2003	Nickel levels worse than Inco admits, lawyer says	CBC News online
30/05/2003	Nickel farms touted as cash crop : would also help clean up city's environment	The Sudbury Star
22/05/2003	Residents have right to be upset, worried	The Sudbury Star
22/05/2003	Morning North : Arsenic Levels in Soil	CBC Radio
21/05/2003	Plan to deal with tainted soil not expected until 2005	The Sudbury Star

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
21/05/2003	Soil study leads to many questions	Falconbridge
20/05/2003	Embracing the soils study	The Sudbury Star
15/05/2003	Residents demand answers	Northern Life
14/05/2003	Medical officer not worried about arsenic levels	Northern Life
14/05/2003	Soil Contamination (interview with Wren and Burnham)	CICI TV
14/05/2003	Arsenic a concern for rest of Sudbury	The Sudbury Star
14/05/2003	Merits of soil study questioned	The Sudbury Star
14/05/2003	The danger below our feet (editorial)	The Sudbury Star
14/05/2003	Soil Quality (interview with Wren)	CBC Radio Morning North
14/05/2003	Soil Contamination (interview with Sutcliffe)	CIC TV
14/05/2003	Falco Residents warned of arsenic: soil study finds levels five-times higher than ministry standards	The Sudbury Star
13/05/2003	Arsenic levels in soil	CBC Radio
13/05/2003	Soil study (interview with Wren and Desaulniers)	Radio Canada
13/05/2003	Soil study (interview with Sutcliffe)	CBC Radio
13/05/2003	Arsenic levels in soil	CJMX FM
12/05/2003	Sudbury Soils Study update scheduled today	SARA News Release and Press Conference
12/05/2003	Soil contamination warning	Radio Canada
10/05/2003	Sudbury Soils Study group reaching out	The Sudbury Star
06/05/2003	Researchers seek public input as part of soils study	The Sudbury Star
06/05/2003	Mining and the environment: powerful decision-making tools	Hazardous Materials Management
02/05/2003	Sudbury Soils Study Gearing up communication efforts	SARA News Release
30/04/2003	Sudbury Soils Study "have your say workshops" May 13th to 15th	SARA News Release
25/04/2003	Lively residents concerned about tailings dust	Northern Life
18/04/2003	Inco, Falco must butt out of Sudbury Soil Group decisions (letter)	Northern Life
07/04/2003	Inco testing nickel eating plants	Northern Life
Spring 2003	The SS: A Unique Area-Wide CBA	Envision (CEI newsletter)
28/03/2003	Sudbury water meets accepted standards	Northern Life
28/03/2003	Sudbury soil subject of study	Northern Life
27/03/2003	Committee studying Sudbury's soil, water and air to seek input	The Sudbury Star
17/03/2003	Survey teams hit the ice to talk to local anglers	The Sudbury Star
14/03/2003	From 'a doomscape to a dreamscape'	The Sudbury Star
12/03/2003	Sudbury Soil Study activities underway	SARA News Release
17/02/2003	Sudbury Soils Study launches website	SARA News Release
27/02/2003	City considers extensive water study	The Sudbury Star

Table B.4 News Releases and Articles related to the Sudbury Soils Study

Date	Headline / Title	Publication
20/02/2003	Work on Sudbury Soils Study continues	The Sudbury Star

Public Input Workshops
Week of May 12

Sudbury Soils Study | Étude des sols sudburois
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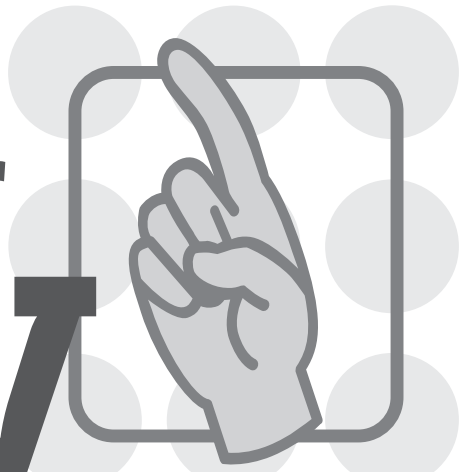
Have your Say Workshops



COPPER CLIFF
Tuesday, May 13 [6 pm to 9 pm]
Italian Club [7 Craig Street]

FALCONBRIDGE
Wednesday, May 14 [6 pm to 9 pm]
Royal Canadian Legion Br 336
[36 Edisson Street]

CONISTON
Thursday, May 15 [6 pm to 9 pm]
Club Allegri [47 Caruso Street]

Workshop Agenda

6:00 PM - 6:30 PM	Reception and Review of Agenda
6:30 PM - 7:00 PM	Workshop Introduction
7:00 PM - 8:30 PM	Working Groups
8:30 PM - 9:00 PM	Sudbury Soils Study Open Discussion

"Have Your Say" Workshops will enable community members to have input into the design and implementation of the Sudbury Soils Study.

These workshops are part of the launch of the two-year study that is evaluating the potential for human health and ecological effects of metals found in Sudbury area soils.

Who should attend?

Anyone who can help us learn more about the lands, waters, and local food that people care about - canoeists, hikers, hunters and trappers, anglers, gardeners, berry pickers, people who buy and sell local produce, and anyone interested in having input to the Sudbury Soils Study. Participants will identify social, economic and natural features of the environment.

Your input will help focus the Sudbury Soils Study on the features of the environment that ***you*** value.

For more information, call
1.866.315.0228

Study Partners:
Inco Limited, Falconbridge Limited, Ministry of Environment, Sudbury & District Health Unit, City of Greater Sudbury, Health Canada [First Nations & Inuit Health Branch]

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www.sudburysoilsstudy.com
questions@sudburysoilsstudy.com

Public Input Workshops
September 4, 2003

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Have your Say Workshops

"Have Your Say" Workshops will enable community members to have input into the design and implementation of the Sudbury Soils Study.

These workshops are part of the launch of the two-year study that is evaluating the potential for human health and ecological effects of metals found in Sudbury area soils.

Band Council Chambers, Whitefish Lake Administration Building

Thursday, September 4 [6 pm to 9 pm]
23 Reserve Road
Whitefish Lake First Nation
[Please use side door]

Refreshments will be provided.

Who should attend?

Anyone who can help us learn more about the lands, waters, and local food that people care about - canoeists, hikers, hunters and trappers, anglers, gardeners, berry pickers, people who buy and sell local produce, and anyone interested in having input to the Sudbury Soils Study. Participants will identify social, economic and natural features of the environment.

Your input will help focus the Sudbury Soils Study on the features of the environment that **you** value.

Workshop Agenda

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For more information, call
1.866.315.0228

Study Partners:
Inco Limited, Falconbridge Limited, Ministry of Environment, Sudbury & District Health Unit, City of Greater Sudbury, Health Canada [First Nations & Inuit Health Branch]

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www.sudburysoilsstudy.com
questions@sudburysoilsstudy.com

You are invited to attend our fourth

COMMUNITY INFORMATION SESSION

WEDNESDAY, FEBRUARY 9th, 2005

3:00p.m. – 9:00p.m.

INCO CAVERN, SCIENCE NORTH

100 Ramsey Lake Road, Sudbury

(Parking is free for Open House participants)

For more information please call 1-866-315-0228

You are invited to attend our fourth

COMMUNITY INFORMATION SESSION

WEDNESDAY, FEBRUARY 9th, 2005

3:00p.m. – 9:00p.m.

INCO CAVERN, SCIENCE NORTH

100 Ramsey Lake Road, Sudbury

(Parking is free for Open House participants)

For more information please call 1-866-315-0228

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Did we see you at our Community Information Session on February 9, 2005?

If not, please check our website www.sudburysoilsstudy.com, for copies of display materials, as well as presentations given by members of the SARA Group, Technical Committee and Public Advisory Committee.

If you would like more information on the study, please send us an email at questions@sudburysoilsstudy.com, or call our toll-free number, **1-866-315-0228.**

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Did we see you at our Community Information Session on February 9, 2005?

If not, please check our website www.sudburysoilsstudy.com, for copies of display materials, as well as presentations given by members of the SARA Group, Technical Committee, and Public Advisory Committee.

As always, if you would like more information on the study, please send us an email at questions@sudburysoilsstudy.com, or call our toll-free number, **1-866-315-0228.**

Sudbury Soils Study

Community Information Session Questionnaire
February 9, 2005

Please look over the displays before completing this questionnaire. If you require assistance or clarification, please ask one of our study team members.

Please return the completed questionnaire to a team member this evening, or mail it to the address below by **February 28, 2005**. Thank you for your time and interest in the study.

1. Please describe your interest in this study (check one).
   a) Property Owner
   b) Interested Citizen
   c) Government Official
   d) Public Interest Group (please specify name) _____
   e) Other (please specify) _____

2. How did you find out about tonight's community information session?
   Mailing Newspaper
   Other (please specify)_____

3. Do you have any particular issues or concerns about this study (please specify)?

_____

_____

_____

4. Considering the human health risk assessment being undertaken by the SARA Group, are you aware of any information that is missing in our studies? If yes, what?

_____

_____

_____

5. Considering the ecological risk assessment being undertaken by the SARA Group, are you aware of any information that is missing about special, unique or sensitive features? If yes, what are they?

_____

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_____

6. Do you agree with the study process for the risk assessments? What else would you would like us to consider?

_____

_____

_____

7. Are you satisfied with the amount of information presented at this meeting? Is there anything else you would like to see on our website, or at future meetings?

_____

_____

_____

8. Did you find this Information Session and presentation useful? Yes_____ No_____
Comments/suggestions?

_____

_____

_____

9. Do you have any further concerns or issues that you would like to bring to our attention?

_____

_____

_____

Thank you for completing this questionnaire. If you would like someone to contact you about any items identified above, or to be included on our mailing list, please provide us with the following:

Name: _____

Address: _____

Phone: (home)_____ (work)_____

Email:_____When can we reach you?_____

For further information or to submit your response, please contact:

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Profiles for Physicians and Other Healthcare Providers

Contents

SARA Sois GROUP

Profiles for Physicians and Other Healthcare Providers

ARSENIC

Arsenic is among the most pervasive toxicants in the world. Many large populations (Taiwan, Argentina, Chile, the Bengal, India, Bangladesh, and USA) are exposed to moderately elevated levels of arsenic on a daily basis because it is in the drinking water. Naturally high concentrations of arsenic in soil do occur in several regions of the world as well. Alternatively, persons who eat a lot of fish and seafood, or who live in areas with localized arsenic in soil, either from natural sources or from industrial emissions, may experience increased body burdens of arsenic. Much of our knowledge about exposure impacts and the health effects resulting from long-term and regular ingestion of arsenic derive from the study of these populations, most especially those exposed to inorganic arsenic in drinking water. Information on arsenic acute and chronic toxicity derives from accidental or deliberate ingestion in a variety of settings, usually not involving environmental contamination.

Arsenic Exposure in Canada

Food and drinking water are the main sources of arsenic exposure in Canada. In general, arsenic from soil and air provide less than 0.01 and 0.2 % of total exposure commitment to arsenic in adults. Canadian data indicate that dust and soil provide about 0.4 to 3% of the total daily exposure to arsenic in all age groups with children's exposure commitment being about 4-9% from soil and dust. In the U.S., about 92% of arsenic exposure is from food, and about 7% from drinking water. Smoking also provides exposure to arsenic. The absolute amount of arsenic exposure from soil will vary for each person depending on arsenic concentration in soil, the individual's access to the soil (personal habits) and eating of produce grown in the affected soil. There is a limited number of studies of Canadian populations impacted by arsenic in soil (Deloro, Wawa, Sydney Tar Ponds), and there are several studies of populations impacted by arsenic in drinking water (Nova Scotia, Newfoundland). Most of these involve urinary measures reflecting exposure, rather than epidemiologic studies relating exposure to adverse health events.

Health Canada has estimated that a typical daily intake for an adult in Canada ranges from 1.0×10^{-4} mg/kg/d (*0.1 µg per kilogram per day*) to 7×10^{-4} mg/kg/d (*0.7 µg per kilogram per day*) and that the typical daily intake for a child in Canada (5 to 11 yrs) is from 2.0×10^{-4} mg/kg/d *(0.2 µg per kilogram per day)* to 2.1×10^{-3} mg/kg/d (*2.1 µg per kilogram per day)*. These calculations are based on consumption of drinking water having an arsenic concentration of 5 µg/L and on background levels of arsenic in food. For Canadians whose exposures via drinking water include higher concentrations of arsenic (ranging from 5 - 500 µg/L or *5 ppb to 500 ppb*), for example, include those in some areas of Nova Scotia, the average daily intake could increase to 0.012 mg/kg/d for adults (*12 µg per kilogram per day*) and 0.012 mg/kg/d for child 5 -11 years of age (*12 µg per kilogram per day*). The Canadian Environmental Protection Act states that for Canadian children, arsenic exposure may be as high as 23 *µg* /kg/d in selected areas with both water and soil contamination. However, how

much arsenic exposure commitment is attributable to each source has not been carefully studied.

Concern about arsenic exposure from local environmental sources and the potential for health effects centre on the period of exposure (long-term) and level of exposure (how much enters the body), as well as the form of arsenic involved (organic vs. inorganic). This determines the risk of observing a given health effect.

Arsenic Metabolism

An understanding of arsenic metabolism allows the understanding of a number of issues related to effect and susceptibility, the measurement of health effects and biological measures of exposure. Arsenic metabolism is well documented. A physiologically-based, pharmacokinetic model for arsenic exposure has been developed in hamsters and rabbits and has been validated in humans.

This model validates some of the following statements which are considered facts about arsenic. Inorganic forms (As III and AsV species) are bioavailable and toxicologically significant. Inorganic forms in water are absorbed readily, in contrast to food arsenic, or arsenic from soil whose absorption may vary considerably. Absorbed inorganic arsenic is distributed throughout the body, excreted into sweat, hair, skin, nails and urine. Absorbed arsenic is cleared from the blood very quickly. The Agency for Toxic Substances and Disease Registry of the U.S. (ATSDR) reports the arsenic urinary half-life is 1-3 days and half-life in blood is 24 hours. If the source of arsenic is removed, the blood level returns quickly to normal, and the body burden resulting from the ingestion of arsenic will decrease rapidly and will be excreted by the kidneys, provided there is normal kidney function. Blood arsenic can change very quickly after a single higher than usual ingested dose, and for this reason, blood arsenic may be helpful in cases of very high dose acute intoxication, but not lower dose exposures as may occur with low level environmental contamination.

Inorganic arsenic is metabolized largely to dimethylarsenic acid (DMAA) and monomethyl arsonic acid (MMAA) by methylating enzymes (e.g. methyltransferases, glutathione-*S*-transferases). These biomethylation products ("arsenic metabolites") are excreted in the urine, and can be measured along with inorganic arsenic, and constitute the components of arsenic exposure reported by laboratories as “non-dietary arsenic” - preferably called "inorganic arsenic and metabolites". As a group, these are considered the more toxic arsenic entities as compared to arsenic linked to other organic entities such as in arsenosugars, and arsenobetaine.

Differences in biomethylation have been observed in children, women, and adults. Differences in biomethylation affect organic components in urine attributable to inorganic arsenic exposure. However, measurement of biomethylation rates is not a readily applicable tool for community studies for evaluating susceptibility, and thus community risk.

Potential Effects

When considering the potential adverse health effects associated with exposure to any substance, it is important to consider *dose-response relationships* in the context of the likely exposure. In most circumstances, human exposure to arsenic is low. In the case of environmental exposure to substances in soil, the high-dose effects that may give rise to

frank toxicity are unlikely, that is, toxicant effects manifest at high levels of exposure, not at low levels.

Even though low-level exposures to arsenic generally are not directly responsible for overt health effects in individuals, a risk of potential effects still exists for the population. The magnitude of the risk for toxicological impacts can be calculated even in the absence of manifest effects in individuals. The potential for adverse effect is expressed in terms of lifetime risk of a specific outcome such as cancer.

Long-term exposure to arsenic is associated with an increased risk of cancer of the skin (squamous cell), bladder, liver, kidney and prostate. Lung cancer risk is increased with occupational exposure to arsenic (smelting). Lung cancer would not be expected as an outcome from typical residential exposures experienced from soil contamination.

Arsenic is classified as a human carcinogen by the International Agency for Research on Cancer (IARC), the U.S. EPA and the World Health Organization. These classifications indicate that there is enough human epidemiological data on both exposure and specific cancer outcomes warranting arsenic exposure control as a carcinogen. Opinions expressed by experts differ as to how arsenic actually causes cancer. It is known that arsenic can interact with other dietary elements such as selenium (present in foods, especially seafood and fish), and zinc, and that these interactions may modify the effects of arsenic on cells. Antimony may occur as a co-contaminant in drinking water so that its influence in the effects seen with arsenic may be also important, but not well characterized. Hence, although a lot is written about arsenic's cancer causing effect, there is not a lot known about why cancer rates are higher in some populations exposed to arsenic, and not as high in others given the same exposure.

Acute Intoxication

Inorganic arsenic intoxication is accompanied by nausea, vomiting, anemia, abnormal cardiac rhythm and peripheral neuropathy (pins and needles in hands and feet). Short-term (on the order of days to weeks) exposure to high levels of arsenic may result in gastrointestinal irritation, difficulty in swallowing, thirst, abnormally low blood pressure, convulsions, and, in extreme cases, cardiac failure leading to death. The estimated lethal dose for an adult weighing 70 kilograms is in the range of 70 to 280 milligrams. Unborn fetuses, young children, the elderly and chronically ill individuals may be affected at lower levels. Clearly, these clinical events are not observed in conditions of low-level environmental exposures.

Chronic Intoxication

Symptoms or indications of long-term ingestion of inorganic arsenic may become apparent as skin lesions. These may include darkening or discoloration (hyperpigmentation), skin cornification in palms and soles (skin thickening), and wart-like lesions in palms, soles and torso. Other symptoms include nausea, diarrhoea, decreased production of blood cells (anemia), abnormal heart rhythm, blood vessel damage, and numbness in the hands and feet. These effects have been observed among populations experiencing high exposure to arsenic from drinking water, *but not soil*, at concentrations many times that experienced or expected in any Canadian community, even where there is evidence of locally contaminated areas.

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Effects on Children and the Fetus

Effects on children are likely to be similar to adults. In the presence of maternal toxicity, it is expected that the fetus would be similarly affected and such effects result in developmental toxicity. Birth defects have been observed in animals exposed to arsenic but similar observations have not been made in humans. There is insufficient evidence that inorganic arsenic impairs fertility.

Tests to Determine Arsenic Exposure

There are sensitive and specific laboratory tests to determine the level of arsenic in hair, nails, bodily fluids (blood/serum/urine), and tissues. The application of a particular test to detect levels of inorganic arsenic varies with circumstance.

Detection of Arsenic in Hair, Nails and Tissues

It has been proposed that levels of arsenic in nails and hair determined via standardized testing procedures can be useful to assess long-term exposures to arsenic. The levels detected reflect arsenic deposited at the time of hair and nail growth. The quantitative evaluation of systemic exposure through hair and nail analysis is uncertain. Unfortunately, the analysis of metals in hair does not readily differentiate external contamination from internal (absorbed) arsenic deposited in the shaft of the hair as the hair grows. Despite these drawbacks, external tissue arsenic measurement is useful in *forensic examinations* of potential arsenic intoxication but is not intended to be used in the context of low-level environmental contamination.

Detection of Arsenic in Urine

Arsenic is excreted from the body very rapidly, primarily through the urine. The half-life is about 1-3 days (some references report 2-4 days). Excretion is dependent on normal kidney function. Hence, urinary arsenic provides a reasonable measure of current exposure. Urinary arsenic levels in normal low-level exposed populations, without specific inputs from environmental sources, range under 100 µg /L for total arsenic. This represents the sum of both food (primarily organic) arsenic and environmental (inorganic and metabolites of) arsenic. Shellfish and many ocean fish have considerable arsenic, more than 90% of which is organic arsenic in the form of arsenosugars and arsenobetaine. This is normal and not considered a harmful source of exposure, even though there is some small proportion of inorganic forms. Blood levels of arsenic can rise significantly following ingestion of seafood or fish (especially shell fish).

Laboratory tests can differentiate the food (organic) and general environmental (inorganic and metabolites MMAA and DMAA) arsenic types. Most food arsenic, especially fish and seafood, is in the form of organic arsenic. On the other hand, arsenic in garden vegetables may not be organic, and could be a source of exposure to inorganic arsenic.

Conditions of consistent low-level exposure are most frequently associated with sources of arsenic in drinking water. In the event that environmental contamination of drinking water is suspected, urinary levels of arsenic offer the best means for determining evidence of exposure. Laboratory studies in multiple populations have shown that random urine, morning

urine, or 24-hour urine are closely correlated with drinking water exposure. A standardized procedure can be applied to remove the organic (harmless) arsenic, to provide a means to clearly distinguish the presence of inorganic arsenic species and its metabolites. Hence, when exposure from water is suspected, a urine arsenic analysis is a rapid and accurate measure of continual exposure to inorganic arsenic.

A clear concern of residents may be related to effects of direct contact with arsenic in soil via the skin. Unlike the straight forward detection of exposure to arsenic in drinking water, assessing exposure via contact or ingestion of contaminated soil by level of urinary arsenic is a much less certain method to clinically determine daily intake. Exposures via soil tend to be less uniform than via drinking water, producing more erratic analytical results. Such exposures rely heavily on personal activities, and require intimate contact between an individual and the contaminated soil so as to make soil ingestion more likely. Generally, toddlers and children are most susceptible to arsenic exposure during warm months or when soil is not covered with snow or grass. Typically soil exposures are higher for children than adults because of frequent direct contact with soils during play and other outdoor activities. During the winter, exposure, and consequently urinary arsenic levels, falls for all groups when soil and not water is the primary source of environmental contamination.

In summary, circumstances and historical experience suggest that testing for arsenic exposure is best done during summer months if one desired to capture the potential exposure impact of arsenic in soil. Results of such testing protocols generally reflect the upper bounds of potential exposure from soil. As a consequence of this generally accepted approach to community exposure assessment, interpretation of long-term risks should always bear in mind the conditions of testing and the potential attribution to the exposure source. That is to say, for the purpose of evaluating risk from arsenic exposure from soil contamination, data collected in the summer months will always provide worst-case predictions unless some special conditions of exposure are known to occur.

What Assistance Should Patients Expect From Their Doctor?

A number of assumptions are required prior to attributing future health risk to current measured levels of urinary arsenic. One such assumption accepts that the pattern of exposure has not varied over some period, and thus the value of the sample obtained is representative of long-term, continuous exposure. On the other hand, if the total urinary arsenic is higher than normal, it does not necessarily follow that a person has been exposed to the more toxic inorganic arsenic, or that there is necessarily a risk of adverse effects. *It is very important to determine dietary habits and occupational exposure as part of an overall assessment.*

It is possible to predict long-term risk as derived from epidemiologic studies of long-term exposure. A toxicologic reference dose for non-cancer effects, which is the level of exposure at which no adverse effect is expected, can be calculated from arsenic concentration in urine.

Studies of urinary arsenic demonstrate that most adults and children have arsenic levels less than 100 micrograms total arsenic per litre of urine, and less than 20 micrograms inorganic arsenic per litre when corrected for creatinine levels. The few populations tested in Canada show arsenic in urine around 8+/- 6 µg arsenic per gram (urinary creatinine).

Laboratory results are frequently supplied in a variety of formats and units. Such data may be converted for purposes of comparison with the reference dose by application of the appropriate formula (provided below).

People who are concerned about personal exposure to inorganic arsenic can take simple precautions to reduce or diminish the possibility of exposure. These steps can be taken regardless of whether there is evidence that arsenic is present in a residential environment:

1. Limit soil contact, especially if living in an area with higher than background arsenic in the soil. Soil contact may be limited by washing hands frequently, preventing children (especially toddlers) from activities where they might ingest soil, reducing garden root vegetable intake.
2. If drinking from a well, especially in an area with natural high arsenic in the soil, ensure that the water arsenic level is low or as low as possible.
3. Use protective masks when handling arsenic treated wood to protect from saw dust.
4. Decrease or eliminate smoking.

Physical examination to confirm any clinical signs of toxicity to arsenic involves the examination of the skin, especially palms and soles; testing for past exposure (arsenic concentration in nails or hair, or human tissue at autopsy); and current exposure (urine total and inorganic arsenic). Appropriate tests of nerve conduction, cardiac function, and hemoglobin status may also be helpful.

Sources of Information:

1. ATSDR, 2000 Fact Sheets
2. Arsenic: Toxicology Profiles prepared for the Port Colborne Community Health Study. June 2001.
3. Fact Sheets from the Hastings and Prince Edward Counties Health Unit compiled for the Deloro Health Risk Assessment regarding arsenic exposure in the Village of Deloro. (Dr. Lynn Noseworthy)
4. Survey of Arsenic exposure for residents of Wawa (Ontario), January 2001.
5. Health Canada: Arsenic In Drinking Water http://www.hc-sc.gc.ca/english/iyh/environment/arsenic.html

Formula for the conversion of laboratory results for arsenic in urine

Reference: Goss Gilroy Inc. Survey of Arsenic Exposure for Residents of Wawa (Ontario), January 2001.

$$As\ (\mu g / L\ in\ urine) = \frac{(\mu mol\ As / mol\ creatinine)(mmol\ creatinine / L\ urine)(As\ mol\ weight)}{1000}$$

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Profiles for Physicians and Other Healthcare Providers

COBALT

Cobalt is an *essential* element associated with vitamin B12 (cyanocobalamine). In non-industrial settings, people are primarily exposed to cobalt from food and beverages. Cobalt is not a cumulative toxin and is mainly excreted in urine and to a lesser extent via feces. An unusual outbreak of cardiac toxicity (cardiomyopathy) occurred in the 1970s among heavy consumers of cobalt-fortified beer where cobalt was used as a foaming agent, and intake was quite high. The contribution of ethanol in this outbreak cannot be excluded. Supplementary addition of cobalt is no longer permitted in any commercial beverage.

Occupational exposure to cobalt can occur. Excessive cobalt exposure may occur and lead to cobalt toxicity in selected industries (production of cobalt powder, production, processing and use of hard metals - iron, aluminum, etc., polishing diamonds with cobalt containing disks, processing of cobalt alloys, and porcelain painting with cobalt dyes). Industrial toxicity mainly affects the skin (allergic contact dermatitis), lungs (asthma), and thyroid gland (goiter and myxedema). Several types of lung conditions (pneumonias) may occur in hard metal polishing and mining, but such conditions are usually related to cobalt and other metals (e.g. tungsten) in industrial dusts.

Toxicity occurs in special circumstances leading to very high levels of exposure and is not expected to be a problem with soil contamination alone. For practical purposes, skin allergy (contact dermatitis) is the only adverse impact that may be reasonably expected from cobalt occurring together with nickel in the immediate environment.

Tests to Determine Cobalt Exposure

Cobalt in blood and urine mainly reflects recent exposure, with soluble cobalt absorbed more readily than insoluble cobalt salts, and this is reflected in urinary cobalt. Such monitoring is useful in industrial settings only and of little to no value for individuals with community low-level exposure to cobalt in residential soils. Biological measures are useful in industrial settings, and as community low-level exposure measures for groups, not individuals.

Biological monitoring for cobalt exposure by general physicians and in non-industrial settings is not indicated.

The web sites below have reliable, current information.
MOE Ontario http://www.ene.gov.on.ca/cons/3793e.pdf
http://www.ithyroid.com/cobalt.htm

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Profiles for Physicians and Other Healthcare Providers

COPPER

Copper, as other elemental metals, occurs naturally in rocks and soils in the environment. It distinguishes itself from other metals in that it is absolutely *essential* for normal metabolism in humans (and plants and other animals). Copper is used as a treatment for plant diseases, in water purification, and for wood, leather and fabric preservation. Copper is used extensively in our society for wire, sheet metal, pipes and for the all-familiar coins.

Exposure to Copper

Exposure to copper occurs through food, air, water and soil, and from handling of coins (through the skin).

Guidelines for copper intake reflect essentiality and low toxicity. Health Canada (1996) reported a Provisional Tolerable Daily Intake of 50 to 500 µg/kg copper/body weight/day, based on technical reports from annual meetings of the Joint FAO/WHO Expert Committee on Food Additives (JEFCA). Drinking water guidelines set by the Ontario Ministry of the Environment (MOE, 1985) recommend a drinking water level of 1.0 mg/L. This recommendation is not based on toxicity but rather on the basis of aesthetic values, such as objectionable taste, colour, and staining. The maximum concentration in water for copper is dictated by treatment techniques, including optimization of corrosion control, with an action level of 1.3 mg/L as determined from tap water samples.

Potential Health Effects

When considering the potential adverse effects associated with exposure to a substance, it is important to consider *dose-response* in the context of the likely exposure. In cases of environmental exposure to substances in soil, the high-dose effects that may give rise to frank toxicity are unlikely. In principle, the high-dose potential effects should not be disregarded, but the most likely manifestations are those that are typically associated with the lowest effect levels, regardless of the magnitude of exposure being of short or long term.

Human Health Effects

In humans, trace dietary levels of copper are essential. Nutrients that are termed *essential* are required for normal physiologic function and survival. At very low doses, there is evidence of adverse effects, but abnormally high doses of copper can also produce adverse effects such as liver or kidney damage, anemia, or gastrointestinal distress. A deficiency in dietary copper rarely occurs in humans since most diets have copper in excess of what is required. However, copper-deficiency can occur in many animals and may lead to several different disorders such as anaemia, bone, nerve and cardiovascular disorders, failure of keratinization and reproductive failure.

Copper absorption from the gastrointestinal tract is regulated by body needs through metal-binding proteins (metallothionein) in the epithelial lining of the intestine. A high level of copper in drinking water causes gastrointestinal irritation (abdominal cramps, nausea, vomiting and diarrhea). High, long-term intake from food and water can cause liver and kidney damage, and affects red cells (causing a microcytic anemia). Long-term exposure to copper in air can cause eye, nose and throat irritation.

Skin sensitivity to copper is common, and manifests as a skin irritation or rash (dermatitis).

Copper has not been classified with respect to carcinogenicity. As with most essential elements, copper at normal dietary levels is not likely to be carcinogenic. Copper is not teratogenic (it does not cause birth defects.) Developmental effects in animals treated with high doses of copper salts have been shown but these effects are uncertain for humans.

Clinical Tests and Clinical Disease

Copper-related diseases in humans include Wilson's disease (hepatolenticular degeneration), cirrhosis of the liver, Mediterranean anaemia and hemochromatosis; most of which have been associated with high liver copper concentrations. All of these diseases are rare, inherited as traits which make people susceptible to copper retention and toxicity.

Biological measures of copper levels are not warranted unless a patient requires investigation of one of the specific diseases associated with copper retention, such as those mentioned above. Specialized laboratories can do these tests. However, they are not helpful in assessing low-level environmental exposure situations since copper absorption is regulated and copper is present in many normal exposure media (food, water, etc.). When patients are concerned, reassurance is appropriate after confirmation that anemia, hereditary disease (Wilson's disease, hemochromatosis), and liver disease are absent.

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SARA GROUP

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Profiles for Physicians and Other Healthcare Providers

LEAD

Our experience with lead in the environment and the measurement of population and individual impact of lead exposure spans several decades since it was identified as an insidious and pervasive environmental toxicant. Lead is distributed throughout the environment. Specifically, it has been used extensively in industry, creating pockets of local contamination through industrial emissions, and as a gasoline additive, creating worldwide dispersion. It is also found in paints, creating indoor sources and outdoor sources of potential exposure.

Efforts from the 1970s to the present to eliminate lead from gasoline, paints, and many consumer products (solder, cosmetics, ammunition), and to properly dispose of lead batteries have not been fully successful. The result is that old peeling paint, renovations in older homes, and soil contamination related to exterior paint have become the most common environmental sources of exposure to most children. Pockets of soil contamination, regardless of the original source (industrial or domestic historical accumulations), may pose a risk of exposure in some specific neighbourhoods or public areas. These sources of lead exposure, as well as the lead in our food supply, provide our burden of body lead which has increased over the centuries.

Potential Effects of Lead

When considering the potential adverse effects associated with exposure to a substance, it is important to consider *dose-response* in the context of the likely exposure. In cases of environmental exposure to substances in soil, the high-dose effects that may give rise to frank toxicity are unlikely. Despite this, the high-dose potential effects should not be disregarded, but the most likely manifestations are those that are typically associated with the lowest effect levels, regardless of the magnitude of exposure being of short or long term.

Lead is toxic to many body systems, but especially to the brain, kidneys and reproductive system. As a public health concern, the most important adverse effect of lead is as a neurotoxin. Lead is absorbed into the blood stream and passes through the blood brain barrier. Lead then exerts a toxic effect on the rapidly developing brains of young children and of the fetus (when a pregnant woman is exposed). The toxic effects of lead to the central nervous system may manifest later in childhood as neuro-cognitive deficiencies as measured by a number of clinical tests of behavioral, neurological and intellectual function. In other words, lead exposure during early life can affect many aspects of children's mental development. Recent studies have also demonstrated slightly delayed conception time (time to pregnancy) in highly exposed women

Acute Toxicity of Lead

Acute intoxication in children with lead is rarely, if ever seen in Canada. Even though reports of fatal lead intoxication in children are rare (e.g. children administered folk medicines) they are tragic and entirely preventable. Manifestations of acute toxicity are usually associated with observable effects on the central nervous system such as dulled behaviour, irritability and convulsions. Early signs of toxicity may be seen in the blood, characterized by microcytic anemia and basophilic stippling in the face of normal or high serum iron levels. Occupationally associated toxicity may also be seen, but manifestations in adults vary from those in children. A level of 10 µg/dL (0.48) of lead in the blood of a child indicates that the child has above average exposure and must be investigated for sources and other factors which affect the measurement (see below).

Chronic Toxicity and Population Exposure

Population studies have confirmed that there is a population effect of lead exposure with respect to neuro-cognitive development in children. Research has shown that such changes (e.g. intelligence quotient in children, academic progress) can be observed at the level of statistical significance in an exposed population of children in the absence of individual, clearly measurable clinical effects. Hence, a population approach is required to prevent exposure to this pervasive environmental contaminant through emissions controls, waste disposal, food residue limits, drinking water guidelines and consumer product regulation, as well as an individual approach through awareness and education.

Tests to Determine Lead Exposure

Blood lead is a reliable method of evaluating current and long-term exposure. Finger prick screening is useful when a large number of children are tested in the public health setting. This can be followed by venous blood confirmation of higher levels, and together this practice provides a reliable method for assessing lead exposure in large populations. In individuals, venous blood lead remains the method of choice in investigating and following up a clinical problem or identified high blood lead levels.

Normal Blood Lead Levels

The blood lead level of most children in Canada, outside a local source of industrial contamination, is now very low, in the range of under 3µg/100 mL of blood (3 µg/L is equivalent to the SI unit of 0.15 µmol/L). Surveys of children in concerned communities with pockets of lead contamination (i.e. soil lead levels above background) reveal the average blood lead level is less than 0.15 µmol/L, indicating that the health impact of such contamination is likely to be immeasurable clinically.

Cord blood lead levels in a series of 823 births in Quebec (1990) averaged .094 µmol/L (old units 1.9 µg/100 mL), and .076 µmol/L (old units 1.58 µg/100 mL) in a second series (1993-1995). Maternal smoking was associated with cord blood lead level, and urban residence was associated with higher averages.

All of the figures appear to cluster around a level below 0.2 µmol/L, with a small percentage of children above the intervention level of 10 µg/dL (0.48 µmol/L).

It is important to remember that increased gastrointestinal absorption of lead will be observed if intake occurs (1) on an empty stomach, (2) if the person is iron deficient, and (3) if the intake of calcium is low. This may explain why poorly nourished children often exhibit some of the highest levels of blood lead.

What is the Intervention Level for Lead in Blood and the Nature of Intervention?

A level of venous sample blood lead above 10 µg/100 mL (0.48 µmol/L) is an indication to examine this child's environment for unusual sources of lead exposure. This is part of the mandate of public health departments. Referral to the health department constitutes an appropriate intervention. Health departments are able to carry out the appropriate environmental investigations and to recommend remedial actions, as well as provide information on nutrition.

Follow-up blood testing to ensure that blood lead levels drop is part of the physician's intervention for the individual. The physician may also want to investigate iron status and initiate iron treatment if indicated, as well as recommend nutritional changes. Nutritional assessments for calcium intake, as well as other dietary habits (pica), are also an important aspect of a clinical intervention.

The decision for individual treatment by chelation therapy is determined by recommended algorithms of treatment which depend on a number of clinical tests, including an elevated blood lead level, usually above 25 µg/dL (1.2 µmol/L) and an assessment of blood lead burden and mobility (chelation challenge). However, such children should be under the care of physicians with experience in this treatment. Treatment algorithms have been published by the U.S. Centers for Disease Control and Prevention and have been reported in the current medical literature. *Unchelated* children with blood lead levels between 10 and 14 µg/100 mLl (0.48 - 0.67 µmol/L) are expected to fall below the intervention level in about 10 months if appropriate interventions have been instituted.

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3. ATSDR 1999 Toxicological Profile for Lead
4. Smith L., and E. Rea.Low blood lead levels in Northern Ontario - what now? *Can J Public Health* 1995 Nov-Dec;86(6):373-6.
5. Roberts J.R., J.R. Reigart, M. Ebeling, and T.C. Hulsey. Time for blood lead level to decline in unchelated children. *J Toxicol Clin Toxicol* 2001;39(2)153-160.

Profiles for Physicians and Other Healthcare Providers

NICKEL

The name nickel derives from the German word for "false copper" or "devil's copper" (kupfernickel). Nickel occurs naturally, commonly combined with sulfur (sulphide ores), oxygen (oxides), arsenic and antimony (as arsenides and antimonides) and in silicate minerals. Nickel is not distributed evenly in the ambient environment; in some areas of the world, such as the Sudbury basin, nickel occurs at higher levels than in others. This is known as the local “background" level. Hence, background levels vary around the world.

Exposure to Nickel

Exposure to nickel derives from food, air, and water. Intake of nickel from food sources may be enhanced by nickel in soil where food is grown because nickel is taken up by vegetation, and from cooking food in stainless steel pots. Stainless steel contains nickel, and this may be released to food during cooking. Background exposure to nickel is quite low, and depends on many independent and individual characteristics of the person. Nickel is not absorbed well from food (less than 1%), but is readily absorbed from drinking water (up to 25%). Absorption of nickel from the intestine depends on the solubility of the nickel compound ingested, the presence of agents which bind to the nickel ion and prevent its absorption (chelating agents), the pH level, and other factors. Nickel can be found in the skin matrix when the skin is exposed to soluble nickel such as nickel chloride. [*Note: Chelating agents are certain food components (sulfur and phytic acid, for instance), which can form insoluble metal complexes such as phosphates and phytates with the nickel ion. Other metals can also compete with uptake of nickel much as iron competes with lead uptake. Certain amino acids can also bind with nickel and are believed to enhance absorption*].

Exposure to nickel from food and soil ingestion is measurable by analysis of nickel in urine or blood (serum). People who live near nickel smelters tend to experience higher exposure and/or body burden of nickel than those who do not. Modest increases in nickel above "background" exposures are not associated with any adverse health effects. Recent studies have demonstrated that small incremental increases in nickel intake are not considered harmful (e.g. Russian populations in the Kola Peninsula).

Health Effects

The health effects of exposure to nickel depend on the type of exposure (dermal, gastrointestinal, respiratory), the concentration of the substance in the environmental medium (air, water, soil, food), the period and length of exposure, and the intrinsic capacity for the nickel compound (i.e. species) to be harmful (its toxicity). *Different nickel compounds have different toxicity, so that the actual compound containing nickel must be known to address its potential toxicity in a given setting.*

Accidental ingestion of nickel sulfate and chloride in water (1.63 g Ni/liter) has resulted in sudden onset of symptoms (e.g., nausea, vomiting, abdominal discomfort, diarrhea, giddiness, lassitude, headache, cough, shortness of breath) that typically lasted a few hours but persisted 1-2 days in some cases. The Ni doses in those with symptoms were estimated to range from 0.5 to 2.5 g. All subjects recovered rapidly, without evident sequelae, and returned to work by the eighth day after exposure.

In contrast to acute toxicity from ingested soluble nickel compounds, the health risk to an individual resulting from the potential exposure presented by nickel in soil will vary considerably. Even in areas with high nickel concentrations in the soil, the general public is not at risk of adverse health effects.

For the general public, the main health concern is *nickel contact dermatitis*, an eczematous condition caused by (soluble) nickel exposure locally on the skin. Normally, about 7-10% of females and about 2% of males experience nickel sensitivity, and this has been attributed to contact with nickel containing jewelry (e.g., backs of watches, earrings, etc.). Piercing of body parts and associated exposure to high nickel content stainless steel jewelry is especially important in the development of this nickel-related health condition. Studies have demonstrated that the prevalence of nickel dermatitis has a more direct relationship to the number of pierced body parts than to nickel in the environment (i.e. soil), or to actual nickel exposure through air, food, and water.

Nickel as a Carcinogen

Cancer attributable to nickel exposure occurs in industrial processes where there are mixed exposures to a number of nickel compounds, some of which may be carcinogenic. Compounds associated with nickel carcinogenesis are dusts or mists that contain mainly insoluble compounds such as sulfidic nickel (e.g. nickel subsulfide), and nickel oxide.

Lung cancer and sinus cancer occur in occupational settings with inhaled nickel oxide dusts. Nickel carbonyl is acutely toxic and treatable with appropriate medical regimens. It is still being investigated as a potential carcinogen but there is no evidence to date though there is weak evidence of carcinogenicity in animals. Lung and sinus cancers are not associated with typical, or even modestly elevated environmental, non-occupational exposure.

As mentioned above, certain subspecies of nickel are designated as a carcinogen by the International Agency for Research on Cancer, and by some regulatory agencies. The American Conference of Government Industrial Hygienists' (ACGIH) guidelines on Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are used extensively in legislating occupational exposure levels (OELs). ACGIH does not list metallic nickel as a carcinogen. Sulfidic Ni (mainly nickel subsulfide), and other insoluble nickel compounds (nickel oxide) are listed as carcinogens. Soluble inorganic Ni compounds (e.g. nickel sulphate) are "not classifiable" as carcinogens. The association of soluble nickel compounds with cancer appears to be in mixed exposures to known carcinogens (e.g. some insoluble nickel compounds and tobacco smoke). The relationship is not clear, but there appears to be a promoter effect.

However, it is important to note that there is no evidence to date that low level environmental exposures, as might be experienced with soil contamination with various species of nickel, is a significant consideration.

Biological Measures of Exposure

Urinary and blood nickel reflect exposure and body burden. Modest elevations of nickel in body fluids are seen in people living in areas with industrial nickel soil contamination. However, circumstances where elevated levels of nickel have been detected in residential soils have not been associated with adverse health effects, even in the presence of the measured added exposure. Biological measures are indicative of "internal exposure", and no distinct adverse health outcome has been identified at the levels found in many areas with industrial emissions of nickel.

Urinary and blood nickel are not routine laboratory procedures. Implementing such procedures requires special collection, transport and analytic techniques. While such testing is not recommended as a routine tool, it may be used in community studies to determine community wide exposure impacts. They have no routine diagnostic, prognostic or treatment value except in a community study to measure exposure impacts or to relate them to specific population effects not readily measurable in individuals.

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